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TO

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THE

Malayan Agricultural Journal.

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Malayan Agricultural Journal.

JANUARY, 1936.

EDITORIAL.

Padi for Rice Mills.

In districts where rice production is only sufficient to supply the needs of the local cultivators, the milling quality of the padi is of secondary importance. In such cases, the padi is milled by somewhat primitive methods, and as long as the yields per acre are satisfactory and the growers satisfied with the flavour of the cooked rice, the grower is but little concerned with the amount of rice which may be broken during milling.

The situation is otherwise in the larger padi-growing areas where surplus padi production is sold to local rice mills. The miller naturally looks for padi which does not break during milling. Consequently, the work of the Department of Agriculture in such areas is towards the introduction of strains of padi which not only satisfy the growers' demands as regards yield and flavour, but the miller's requirements as regards milling quality.

Tests conducted in Krian on the milling quality of certain varieties of padi are described in a short article in this number. The results shew that the milling quality of certain padi strains is satisfactory.

The matter has, however, proceeded a stage further, propaganda work being carried out to popularize the cultivation of such varieties of padi as are desired by the millers. Visits of cultivators and headmen in the Krian District to the Government Rice Mill have been made, in order that the grower may appreciate the miller's point of view. A more practical expression has been made by the miller, who now offers a premium for consignments of certain single varieties of padi.

In Kedah, the largest and most important padi-growing State in the Peninsula, the milling qualities of the padi grown are naturally of quite as much importance as they are in Krian, as the surplus crop is very considerable and is all milled for local consumption or for export. In this State, the measures taken to encourage the cultivation of a single suitable strain in each region of uniform conditions have followed the same general lines as in Krian. In this work the rice millers have closely co-operated by such means as the presentation of prizes for suitable milling padi exhibited at the local padi show, and by the offer of a premium on the purchase of suitable strains in sufficiently large quantities.

Rice Production in Madras.

We are apt to look upon our own rice industry as of some magnitude. From the point of view of their value to the country, the 700,000 acres or so in Malaya are of importance, but in comparison with the vast scale of padi-growing in certain other countries our own areas sink into insignificance. It is important, therefore, that we should be informed of the system of cultivation obtaining in other rice-growing countries and particularly of the research work in operation in those areas.

Particular interest therefore attaches to the visit to the Madras padi-growing area of 11¼ million acres which Mr. Lowe of this Department paid in July of last year, a report on which will be found in this number.

This concise report, which is here published with the approval of the Madras Government, will be found of value particularly to those who are making a study in other countries of problems of a somewhat similar nature to those which obtain in the Madras Presidency.

Original Articles.

THE PREPARATION OF REFINED CALOPHYLLUM OIL

BY

C. D. V. GEORGI,

Acting Agricultural Chemist.

Introductory.

An investigation has recently been carried out involving the preparation of a comparatively large quantity of refined calophyllum oil for the Medical Department. Seventy-two pounds of oil were prepared.

This oil, which is being used experimentally in connexion with leprosy treatment at the Leper Settlement, Sungei Buloh, Selangor, is obtained from the fruits of *Calophyllum Inophyllum.*

Description and Distribution of Tree.

C. Inophyllum is an evergreen tree with a short trunk and spreading branches. The tree may attain a height of 60 feet.

It is widely distributed throughout the Eastern Tropics, being found in India, Burma, Ceylon, Malaya and Polynesia (1).

In Malaya the tree is found along the seashore in sandy places; for example, the coast road from Port Dickson to Malacca.

Although, as will be seen later, the oil has been used in the past as an illuminant and also as a medicine, no attempt has ever been made to cultivate the tree on a plantation scale.

In the case of the present investigation the requisite amount of fruits was obtained from the Forest Department.

Composition of Fruit.

The fruits are green in colour, globular in shape, and measure from 1 to $1\frac{1}{4}$ inches in diameter. The ripe fruits gradually turn brown in colour, the surface becoming shrivelled.

The shell of the fruit, which varies from $\frac{1}{8}$ to $\frac{1}{4}$ inch thick, is woody on the outside, spongy in the middle, while on the inside there is a thin, brown, highly-polished lining or skin.

The kernels measure from $\frac{3}{4}$ to $\frac{7}{8}$ inch in diameter. They are yellowish in colour when freshly opened, but turn brown on exposure to air. The discoloration is, however, confined to the surface.

The results of analysis of an average sample of ripe fruit were as follows :—

Fruit

Average weight of fruit	... ...	5.5 grammes
		per cent.
Proportion of shell	... ...	54.0
Proportion of kernel	... ...	46.0
		100.0

Kernel

Average weight of kernel	... ...	2.5 grammes
		per cent.
Moisture	... ...	29.2
Oil (petroleum ether extract)	... ...	52.7
Residue (by difference)	... ...	18.1
		100.0
Oil (calculated on moisture-free basis)	... ...	74.5

Fruit

Oil (calculated on whole fruit)	... ...	24.2

Characteristics of Oil.

The crude oil is dark green in colour and viscous, due to the presence of resin, which crystallizes out to some extent on long standing. The oil possesses a disagreeable odour and flavour.

The resin is acidic and can therefore be removed by appropriate treatment with sodium carbonate or sodium hydroxide, leaving a clear yellow oil. Although the refined oil has only a very slight odour, it still retains a somewhat disagreeable taste.

Some years ago an investigation (2) was carried out to determine the constants of calophyllum oil, which were found to be as follows:—

		Crude Oil.	Refined Oil.
Specific gravity (15.5°C.)	...	0.9411	0.9276
Refractive index (20°C.)	...	1.4814	1.4753
Saponification value	...	184.2	188.3
Iodine value (Wijs)	...	98.1	90.0
Acidity (oleic acid per cent.)	...	17.5	0.9

According to Dhingra and Hilditch (3) the fatty acids of the neutral glycerides of the oil, that is, of the oil free from resin, have the following

composition :—

	per cent.
Palmitic acid	15.8
Stearic acid	10.2
Oleic acid	49.4
Linoleic acid	24.0
Unsaponifiable	0.6
	100.0

Preparation of Oil.

The fruits were decorticated, the kernels cut in pieces and the material dried in a large electric oven, maintained at a temperature between 65° and 70°C., until individual pieces of kernel could be snapped between the fingers.

The dried kernels were crushed between rollers, and the resultant mass heated and pressed in a small laboratory hand-press to remove the oil.

The most satisfactory results from crushing were obtained by treating a mixture, consisting of 3 parts of kernels and 1 part of the residue remaining from a previous expression. If the kernels alone are crushed, the meal becomes very pasty and is difficult to handle.

The crude oil was bulked, allowed to settle and its acidity determined. This was found to be 19 per cent., calculated as oleic acid. Batches of the settled oil were weighed; each batch was then heated to a temperature of approximately 90°C. and treated with an amount of caustic soda (10 per cent. solution) necessary to neutralize the free fatty acids and resin acids, together with a 10 per cent. excess to ensure a rapid separation of oil and "foots".

The clear yellow oil was poured off, washed twice with boiling water to remove dissolved soap and excess of alkali, dried by treating with a small quantity of anhydrous sodium sulphate and filtered.

The refined oil had an acidity of approximately 0.5 per cent., calculated as oleic acid.

The yield of refined oil varies with the state of ripeness and quality of the fruit. The highest yield was 10 per cent. obtained with a consignment of fruits from Port Dickson.

This figure is low, compared with the calculated yield of crude oil, 24.2 per cent. It will be realized, however, that under the conditions of the experiment considerable losses of oil must be incurred, as the small laboratory press has an efficiency of only approximately 70 per cent., equivalent to a recovery of only about 17 per cent. of crude oil on the fruit. Further, the actual loss on refining an oil with an acidity of 19 per cent. will amount to at least 25 per cent., thereby reducing the maximum yield of refined oil on the fruit to about 12.5 per cent.

Application of Oil.

The crude oil was used formerly in India as an illuminant. Its principal application has been, however, for medicinal purposes, notably in skin affections. For example, in Pondicherry the oil has been used for the treatment of scabies, while, mixed with chaulmoogra oil, it has been employed successfully in the treatment of exanthematous eruptions. In Polynesia the oil has long been valued as a liniment in rheumatic affections (1).

In 1932 the Medical Superintendent, Leper Settlement, Sungei Buloh, approached the Department regarding the possibility of preparing a small quantity of the oil for experimental purposes in connexion with the alleviation of nerve pains in leper patients. Information had been received from Fiji that striking relief from nerve pain in lepra reaction had followed the intramuscular injection of small amounts either of the oil or of the ethyl esters.

The original experiments with crude oil were unsuccessful, but experiments with the refined oil—that is, the neutralized oil free from resin—confirmed the results obtained in Fiji (4).

As a result of this work the larger supply of refined oil referred to previously was prepared.

Dr. G. A. Ryrie, Medical Officer, Leper Settlement, Sungei Buloh, whose assistance in the preparation of this article is acknowledged, informed the writer that, as far as he is aware, nothing is known regarding the active principle to which the oil owes its special property.

Dr. Ryrie is of the opinion that since the oil, unlike other analgesics, is not habit-forming, there may be possibilities for its adoption in other affections and diseases associated with nerve-pains.

A supply of the refined oil has been forwarded to the Institute for Medical Research for investigation.

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RICE RESEARCH IN MADRAS

A Report of a Visit to Coimbatore in July 1934

BY

B. A. LOWE,

Botanist (Rice Research).

Conditions of Rice Production in Madras.

The area of land under rice in Madras Presidency is approximately 11¼ million acres, nearly 14 per cent. of the total area under rice in the whole of India, including Burma, and slightly less than the area under the crop in Burma. The average production of padi in Madras is about 5¼ million tons, which gives an average of about 1,700 lbs. (equivalent to about 300 gantangs) per acre. Owing to the adoption of improved methods of cultivation advocated by the Department of Agriculture, and more particularly to the extensive use of selected seed, it is said that the yield per acre is steadily increasing. The figure given above is for the 1930-31 season, the last year for which reliable figures were available, but it is thought probable that the yield is now nearer 1,800 lbs. per acre as the use of seed selected and distributed by the Department of Agriculture is rapidly extending. Such seed has been shown to give increases of between 8 and 20 per cent. over local varieties and it is estimated that nearly 600,000 acres are now regularly planted with selected seed.

The satisfactory cultivation of the crop is primarily dependent on rainfall which is strictly seasonal and determined by the incidence of the monsoons. There are several extensive irrigation schemes which depend mainly on rivers, but they in turn are almost dry except during and immediately after the rainy seasons. Storage tanks and wells are in general use throughout the areas where water from the larger irrigation schemes is not available. Climatic conditions vary enormously in different parts of the Presidency, and, in consequence, many different systems of padi cultivation are to be found. Variations between one crop in three years and three crops in one year, between three and seven-month varieties, and between dry and deep-water padi are to be found.

The main rice-growing areas fall naturally into three groups :—the Malabar coast west of the Ghats, the dry central area, and the delta tracts on the east coast.

On the Malabar Coast, between the foothills of the Ghats and the Indian Ocean, the land is gently undulating, low hills alternating with shallow valleys in which the rivers are dry for about six months in the year. Practically the whole area is under mixed cultivation and, in general, rather resembles the low country of Malaya. The soil, which is of a lateritic nature, is thin and poor, rarely exceeding a thickness of an inch or so on hilltops or a couple of feet in the valleys. On the hill-tops and the upper slopes, dry padi is grown

once in two or three years in rotation with horse-gram, gingelly, bananas and other crops. An effort is being made by the Department of Agriculture to include pineapples (of which the Kew pine is recommended) in the rotation, as this crop has been found to give a remunerative return locally. Owing to the poverty of the soil, the growth of crops on the hills is poor. Padi is considered an exhausting crop, and, on the poorest soils, it is frequently necessary to allow one or more years of fallow after each crop. The lower slopes of the hills are terraced and irrigated from storage tanks and rivers in addition to rain which is the main source of water supply. On these terraces one $3\frac{1}{2}$ to 4 month crop of wet padi is grown each year between June, when the monsoon breaks, and the end of September; for the rest of the year the land lies fallow. On the lower lands in the valleys, two short crops of padi are raised each year. The first crop is transplanted in June along with the padi on the terraces, and reaped about the end of September. Before this crop is ripe, nurseries are laid down for a second crop which is planted as soon as the land is cleared of the first crop. Sufficient water for irrigation of the second crop is available in storage tanks and wells and in the drainage from the terraces. A small amount of water is also available from the rivers which flow for several months after the cessation of the South-West Monsoon in October.

The Central district is generally dry, having a rainfall of 20 to 30 inches per annum. Conditions vary greatly, but as a rule one five-month crop of padi is raised each year. The months of January to June are very dry, but the influence of both the South-West and North-East Monsoons is felt to a limited extent between June and January. Padi is irrigated primarily from seasonal rivers supplemented by water stored in tanks and wells, but it is by no means infrequent for the rains to fail and cause the complete loss of the padi crop. Perhaps partly for this reason, the crop is usually grown in a two or three years rotation with a variety of other crops such as pulses, cotton, sugar cane, plantains and grams. In the very dry districts, which are limited in area, sorghums and millets may also be included in the rotation when an unusually dry year is anticipated.

The delta areas, which comprise the two extensive tracts of land watered by the Godavari and Caveri, with one or two minor rivers, account for the greater part of the rice land in Madras. The influence of both monsoons is felt and the rainfall is usually about 50 inches per annum. Elaborate irrigation systems distribute the water from the rivers. Soils are very deep and rich and are entirely of alluvial origin. Under these conditions heavy crops of over 3,000 lbs. of padi per acre are not infrequent. On about two-thirds of the area a single six-month crop is grown between June and December, while the remaining third carries two crops per annum, one of long and one of short duration. In the delta of the Godavari the long-term padi is grown between June and November and the short between February and May, while in the Caveri delta the reverse is the case, the short-term crop being grown between June and

September and the long between October and February. These differences in planting dates are determined by the availability of irrigation water. For the most part, padi is grown as a sole crop on the delta lands, though the Department of Agriculture is successfully advocating the growing of a green manure crop in the off-season between February and June.

Types of Rice Grown and Distribution of Selected Seed.

It is estimated that more than a thousand varieties of rice are grown in India, and of these a large number are cultivated in Madras. Considering the size of the Presidency, the great diversity of climatic conditions, and the comparative isolation of many of the districts, this diversity is not surprising. Formerly, practically all the varieties grown were very mixed and no attention was paid by the cultivator to the growing of unmixed strains. During the last twenty-five years however, the Department of Agriculture has popularized improved cultural methods and advocated the use of selected seed with very definite results. These selected strains have been shown to give increases of between 8 and 20 per cent. over the local mixed varieties; in addition, there is an advantage to the millers in dealing with standard varieties. The last-named point is perhaps of rather greater importance in Madras than in Malaya as by far the greater part of the padi grown is milled by machinery for the growers who pay in cash or in rice for the milling. It is stated that almost every village in the rice-growing districts has a good mill run by a local business man or company.

The total number of strains selected by the Department and now grown commercially is about thirty. Most of these strains have some special feature such as early maturity, better quality of grain, strength of straw or resistance to disease, which makes them of particular value in given localities or under special circumstances. The raising of hybrid strains is a comparatively new development, but several very promising hybrids have now been produced and are just reaching the stage of final trial and distribution. Many varieties of padi have been introduced experimentally from all over the world but, almost without exception, they have proved entirely unsuitable to local conditions. Now that hybridization work has been fully established however, it is possible that some of these imported varieties may contribute useful characters which can be incorporated into local strains.

A selected strain or hybrid produced at one of the rice stations is normally tested for several years against standard varieties by the strip trial method. If satisfactory it is then distributed to the other rice stations and to the Administrative Agricultural Officers for further trial. The Administrative Officers conduct a further series of strip trials on land owned by the villagers who are paid for their labour and allowed to keep the crop harvested. The Agricultural Officer examines the crop during growth for the removal of "rogues", and at harvest weighs the crop. If the final trials are satisfactory, the grower usually sells his crop of the new selection to the neighbouring

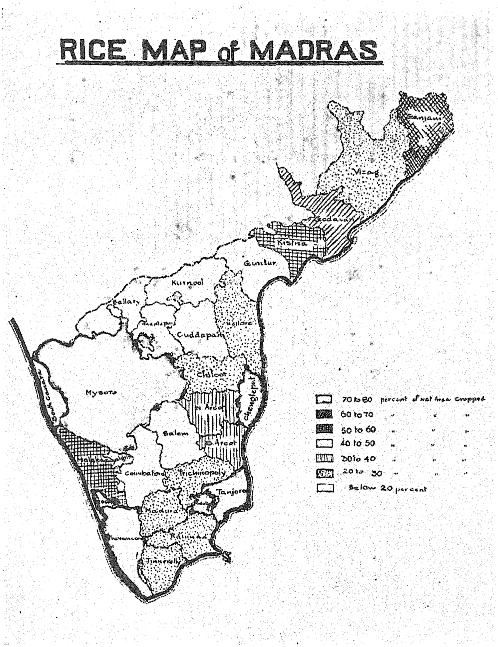
cultivators. Apart from a general interest in the new variety the Department does not interfere in any way with this individual. He simply multiplies the new selection and sells his crop for seed purposes to the people in his district. He usually receives a premium of 10 to 15 per cent. above the local market price of padi for his seed. It is very note-worthy that the demand for "proved" varieties always exceeds the supply, and there is not the slightest difficulty in distributing a good padi once it has definitely shown its worth. As an instance of rapid and successful spread of a new strain, it is stated that the selection known as G.E.B. 24 occupied an area of only 5 acres in 1926-27 season in one of the tracts but had, by the 1930-31 season, spread over 15,000 acres. The grower's keenness for better varieties is ascribed partly to the fact that he has never yet found his confidence in Departmental advice misplaced. The greatest care is always taken to test a new variety in the district where it is to be grown before its general distribution is permitted.

Organization of Padi Work in Madras.

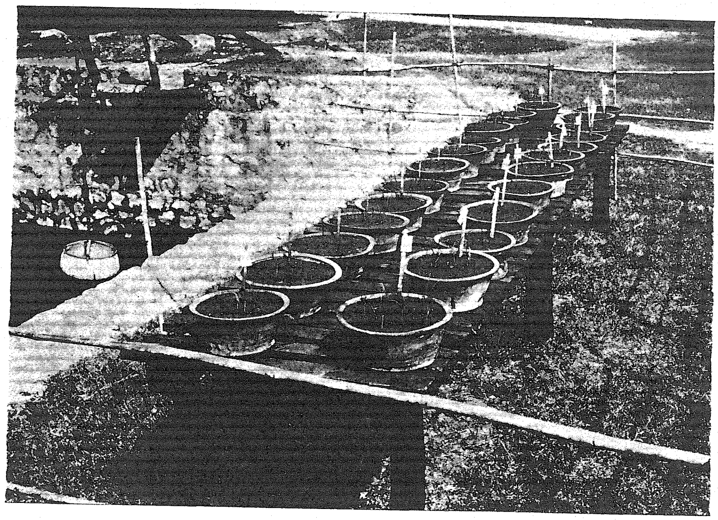
The headquarters of the Department of Agriculture are situated in the city of Madras, but the Division in charge of rice work has headquarters at Coimbatore, some 300 miles to the south-west of the capital. The reason for this is that the Agricultural College of Madras University is situated at Coimbatore. Suitable research facilities are thus provided for Departmental officers, who in turn are in a position to afford technical training to students. Also, post-graduate students are in a position to receive advanced technical training while at the same time dealing with research problems under the guidance of specialists. This system has the further advantage that prospective applicants for appointments in technical divisions are in close touch with the work in progress throughout their university and student research periods.

A further advantage of Coimbatore as a headquarters lies in the fact that it is centrally situated with regard to the main padi-growing districts of Madras, though Coimbatore itself is unimportant as a rice-growing province.

The Rice Section of the Department carries on work on padi in all its aspects, systematic, agronomical, physiological, genetical and cytological. In addition to purely economic work, fundamental work on the genetics and cytology of rice is carried out at the Coimbatore station directly under the supervision of the Padi Specialist. There are four stations, one in each of the important padi-growing tracts of the Presidency, and each under the direct charge of a resident Superintendent who has a considerable trained subordinate staff to assist him. Work on these sub-stations is mainly directed towards improvement in yield by the evolution of improved strains and by investigation of agronomic practices suitable to the particular tract in which the sub-station is situated. The more fundamental and technical work is confined to the central station at Coimbatore.



(Published by courtesy of the Director of Agriculture, Madras.)



RAISING F_1 PLANTS IN POTS.

(By courtesy of the Director of Agriculture, Madras.)

The staff of the Division consists of the Padi Specialist, four station superintendents, each of whom is a post-graduate officer fully trained in modern experimental and statistical methods, about a dozen highly-trained assistants who are mostly post-graduates with experience of research work, and several field clerks. In addition to the above, there are also research students of Madras University engaged in technical laboratory work at Coimbatore.

Work Done and in Progress.

During the twenty-two years since the Division was constituted, an enormous amount of general and specialized rice work has been accomplished. Much of it has been recorded in *The Indian Journal of Agricultural Science,* some of it in special pamphlets and bulletins and some in special memoirs. The main lines of work done and still in progress may be briefly summarized as follows :—

(1) *Agronomical.*

(a) *General Reduction of Seed-rate.* Formerly it was the usual practice for cultivators to use from 50 to 100 lbs. of seed in the nursery for each acre of land to be planted. One of the first investigations of the Division was on the question of seed rate, and it was found that with reasonably economical use 20 to 25 lbs. per acre were ample. The more moderate seed-rate has been widely advocated throughout Madras, and it is now uncommon to find excessive wastage of seed-padi under normal conditions. It is estimated that the annual saving in rice thus attained is enough to feed the whole population of Madras for one week.

(b) *Manurial.*—A large number of manurial trials have been carried out during recent years under much the same conditions as those carried out in Malaya. These experiments are still in progress, though it was understood that, in general, results are similar to those attained in this country; that is to say, the use of artificial fertilizers is generally uneconomic. In some cases significantly good results have been obtained from the use of superphosphate or bone-meal in soils which are believed to be deficient in phosphates. A light top-dressing of ammonium sulphate has generally given some increase in yield, though it is considered uneconomical to apply this dressing in areas where the yields are below 3,000 lbs. per acre. In the best delta areas where yields are very high, the use of a light dressing of ammonium sulphate is becoming fairly common. Experiments on the use of lime (at rates of 500 lbs., 1,000 lbs. and 2,000 lbs. per acre) applied just before transplanting, are at present in progress. The chief successes in the way of manurial experiments have been achieved by the growing of green manures. It has long been the custom in India to apply heavy dressings of green material, usually the leaves of forest and roadside trees, before preparation for padi. The Department of Agriculture therefore conducted a number of experiments with green manures grown on the land during the off-season. The results were most encouraging, and it was found possible to establish green manures in most areas where a little water could be made available for starting growth. The growing of such manures has been readily

accepted by the cultivators and the practice is rapidly spreading wherever conditions are suitable. The most commonly used crops for this purpose are *Tephrosia purpurea, Crotalaria juncea, Sesbania aculeata* and *Phaseolus trilobus*, the selection of the particular species depending on the soil and other local conditions. It appears that the general tendency now is to abandon manurial trials with artificial fertilizers and to concentrate on the distribution of seed of green manures; in fact, little more can be done on the question of fertilizers until the "limiting factor" has been further investigated.

(c) *Broadcast-seeding, Transplanting and Spacing.*—Experiments on the relative merits of broadcast versus transplanted crop, of seedlings transplanted at different ages, and of seedlings transplanted at the same age but at different spacings, have been in progress for several years. The indications so far are that there is a definite advantage in transplanting, as a transplanted crop gives significant increases over a broadcast crop except in special tracts. No definite results regarding spacing are yet available.

(d) *Nursery Methods.*—Experiments on different types of dry and wet nurseries and on the application of manures in the nursery are in progress.

(e) In addition, general experiments have been made, or are in progress, on the relation of cultural practice to lodging, on the effect of planting date on yield, on the growing of padi with reduced water-supply and on the comparison of root-systems of various varieties.

(2) *Selection and Breeding.*

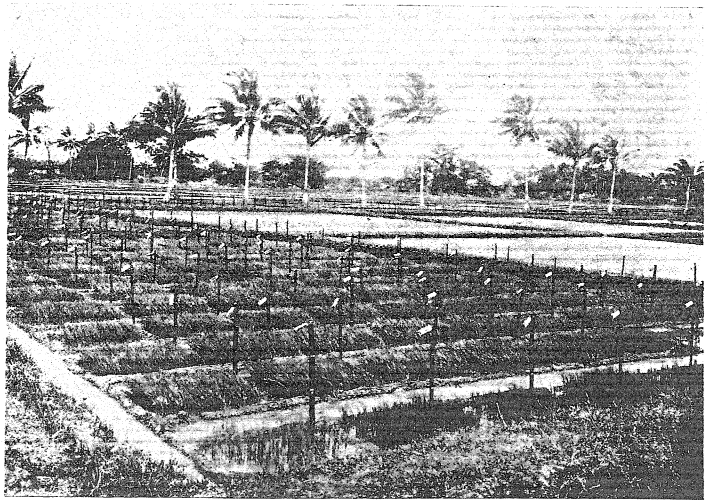
(a) *Selection.*—Most of the important selection-work has been done since 1920. The important selections (*i.e.* those which have attained general popularity) are eight in number, and the general increase in yield resulting from the use of these selections is reported to be between 8 and 15 per cent. over unselected varieties. The main advantages of these varieties, apart from increased yields, are better quality of rice, a higher proportion of shelled rice to padi, slightly quicker maturity, and, in one or two cases, some degree of disease-resistance. Selection is done in the field and pure lines are isolated, grown, and tested at the Rice Stations in a manner similar to that practised in Malaya.

(b) *Breeding for Disease Resistance.*—A variety known as 'Korangusamba', extensively grown in Tanjore, is highly susceptible to a widespread disease known as Padi Blast (*Pericularia oryzae*). Two selections at Coimbatore had been found resistant to the disease and were therefore crossed with Korangusamba. Selections from the hybrid progeny have proved to be resistant to the disease and at the same time to give higher yields than the original Korangusamba. (*Piricularia oryzae* has never yet been recorded on rice in Malaya).

(c) *Breeding.*—The raising of new varieties by controlled breeding is a comparatively new development. A number of hybrids have reached the stage of trials against previous standard selections and results appear to be promising. A very satisfactory breeding technique, giving successes to the extent of over 90 per cent., has been evolved. This technique consists essentially in bagging a panicle in brown paper early in the morning. The

Preparation of seed-beds for single plant lots.

(By courtesy of the Director of Agriculture, Madras.)



SEED-BEDS OF SINGLE PLANT SELECTIONS READY FOR TRANSPLANTING.

(By courtesy of the Director of Agriculture, Madras.)

rapid rise of temperature within the bag causes premature emergence of the anthers before they are ready to dehisce. Emasculation thus avoids any interference with the delicate glumes, and crossing can be done later when the stigmas emerge.

(3) *Genetical Studies.*

(a) Very extensive work of a fundamental nature on the inheritance of various characters has been carried out. Over a hundred genes controlling morphological and metrical characters have been identified and studies are in progress on their linkage relations. The mode of inheritance of colour (in leaf stem, glumes, stigma, and seed), of size and shape of grain, of plant hight, of rapidity or otherwise of maturity, of panicle-length, of intensity of tillering, of strength of straw, of resistance to *Piricularia orysae,* and of other characters has been investigated and demonstrated.

(b) Concurrent with the genetical studies, accurate cytological investigations have been carried out. These have concerned chromosomal aberrations in interspecific crosses, chromosomal irregularities in dwarfs, sterile plants and artificial mutants, the formation of chromosome rings and other highly technical cytological problems which are outside the scope of a general report.

(c) At present an investigation on the effect of X-ray treatment of seed in the production of mutations is in progress. Very rare natural mutants (such as those exhibiting chlorophyll deficiency) can be artifically produced by exposure of seed-padi to X-rays in varying doses and some interesting results are anticipated.

(d) A recent investigation into the question of heterosis in padi confirms the results obtained with many other crops; *i.e.* that the F_1 progeny of a cross frequently exceed both parents in general vigour and yield. This problem is undergoing further investigation.

(4) *Physiological Studies.*

(a) Experiments on the "vernalisation" of padi are in progress along the same lines as in similar experiments with other cereals in Russia. This may have some practical application in India where in some districts a shortening of the growing season is of paramount importance, but would seem to be of little value in Malaya where a slight shortening or lengthening of the maturation period is immaterial.

(b) *Root Studies.* Preliminary investigations into the development of root-systems of a few selected varieties of padi under different cultural treatments were undertaken during the last season. It was observed that (1) the zone of root-formation is lower in the soil in the case of transplanted padi than in the case of padi not transplanted; (2) a "floating" variety of padi which is particularly prone to lodging has a relatively poor root-system; (3) the root-system is generally more extensive when grown under puddled conditions than under dry-land conditions; (4) the more frequent the irrigations given, the deeper and more extensive is the root-system; and (5) manuring

increases the bulk of the root-system. These investigations are being continued during the present season.

(c) *Influence of Environment on Size of Grain.* It has been found that certain pure strains of padi develop a coarser or finer grain according to the district in which they are grown. Investigations into the possible cause of this effect are in progress.

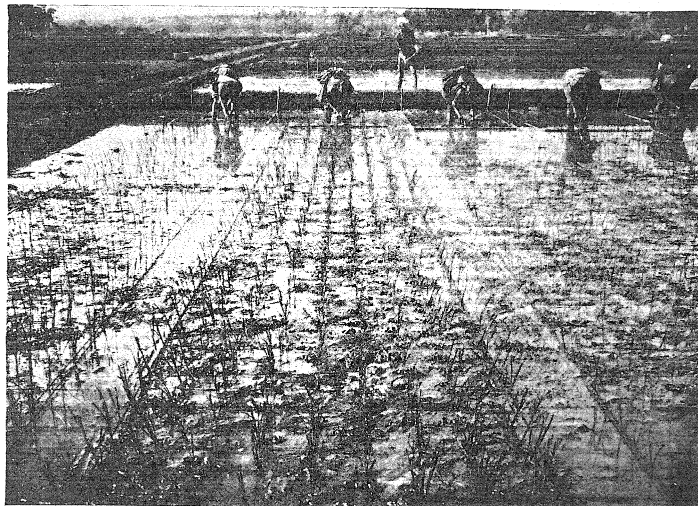
(5) *Collection and Maintenance of Varieties: Classificatory Work.*

A collection of over a thousand varieties of padi has been formed both from local and foreign sources. This collection is maintained more or less as a living herbarium. The great majority of varieties are grown as pure lines each year. The collection includes varieties from temperate climates (North America and Italy) but such as have been tried are failures from the commercial point of view as the local climate causes premature flowering. Similar results have been obtained in Ceylon and Malaya. Each variety grown is described in detail every year and the record carefully preserved. This would seem to be a laborious and perhaps unnecessary routine, but it has the advantage of ensuring that varieties are kept true to type. It also gives valuable training in accurate observation and description to the younger research Assistants. A collection of this magnitude requires a fool-proof yet simple system of recording and it has been found satisfactory to grow each variety under a type number each season. The single plant selections made for inheritance studies and for evolving economically useful strains are given individual numbers which run consecutively from 1 to 10,000. When a series is exhausted, a new series is started. At present the second series of 10,000 is nearing completion. A numbered page in the record books is allowed for each variety every season and it is a simple matter to 'carry forward' and record the number under which any given variety was grown during previous years. It is thus easy to refer back to any season for information about a variety then grown.

A certain amount of systematic classificatory work has been done at Coimbatore, but as elsewhere, the officers concerned have found it very difficult to devise a satisfactory and accurate system. There is so much intergrading of characters, while the morphological features of padi may be so greatly influenced by environment, that the general opinion seems to be that any but the broadest of classifications are, even if possible, hardly worth the trouble. In actual practice, officers regularly dealing with padi can more readily classify a variety by eye than they could by the use of key-tables or by reference to descriptions.

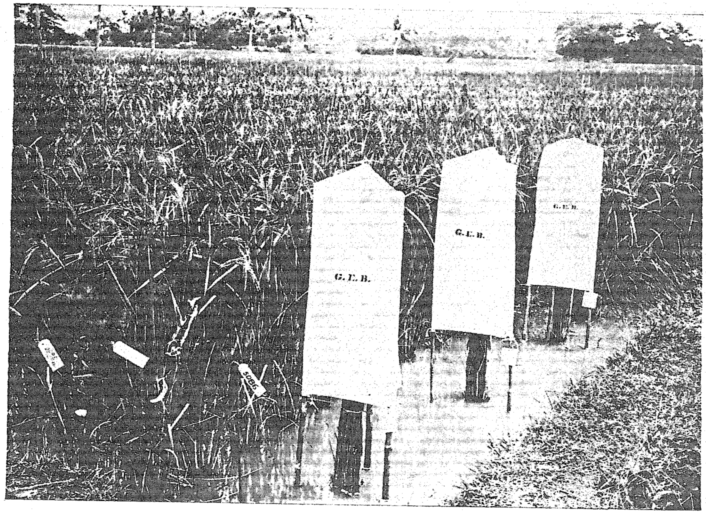
Rice Station in Madras.

The four rice stations under the control of the Department of Agriculture are as follows:— Tanjore in the Caveri Delta (area 55 acres), Maruteru in the Godavari Delta (area 50 acres), Potambi on the Malabar coast (area 110 acres), and the central station at Coimbatore (area 30 acres).



TRANSPLANTING COMPARATIVE TRIALS, COIMBATORE.

(By courtesy of the Director of Agriculture, Madras.)



METHOD OF "SELFING" RICE-PLANTS.

(By courtesy of the Director of Agriculture, Madras.)

The two stations visited were the central station at Coimbatore and the Pattambi station on the Malabar coast. Visits were not paid to the Delta stations as it is stated that they are similar in organization and purpose to the Pattambi station.

Coimbatore Central Station.—This station, which has been in existence for about twenty years, has an area of thirty acres and is situated about two miles from the main buildings of the Agricultural College. The land is very slightly sloping and consists of fairly good medium-heavy soil. It is enriched annually by the growing and ploughing in of leguminous green-manures (*Crotalaria juncea, Sesbania aculatea* and *Phaseolus trilobus*). Apart from rain, water is obtained from a local seasonal river, supplemented by four large storage tanks. Two of the latter are fitted with motor-pumps for occasional use, though, except in emergency, bullocks are used for raising the water to ground-level. The station is divided into ten main blocks, each of which is subdivided by means of bunds into small level fields. It is interesting to note that, in the demonstration area, the bunds are cut with a vertical side facing downhill, and a slope of about 60 degrees facing uphill. In re-forming bunds, earth is always cut from the lower side and piled on the upper in order to counteract the tendency of the bunds to move slowly downhill and thus, in the course of years, to alter the position of the fields. A small portion of the station which is situated in high land is being utilized for breeding work on tomatoes, chillies and egg-plants. Five acres of padi land are used as a demonstration area.

The permanent buildings of the station consist of a combined office and field laboratory, a large and particularly well-equipped store, housing for cattle and a rat and bird-proof breeding-cage. There are, in addition, several small stone-faced threshing and drying-floors.

Features of interest noted were as follows :—

(1) The very convenient method of storing seed-padi. Single plant seed is kept in a glass-bottle with metal screw-on tops. Pure line seed is stored in larger zinc cans, and bulk crop is stored in large cylindrical bins which have a capacity of over 200 lbs. of padi.

(2) Loss of seed through the ravages of grain-moth can be prevented by covering the padi in the bins with a layer of fine sand which prevents the re-entry of moths into the padi after their emergence. This is simple, cheap, and does not prevent the padi being used for food if it is not required for planting. (Chemical insecticides may make the padi unpalatable).

(3) The method of growing pure-lines under type numbers, (to which reference has already been made), and the very neat and absolutely permanent records kept in strong record ledgers.

(4) The disinfection of all seed with "Cerosan" immediately prior to sowing as a precaution against attacks of "foot-rot" (*Fusarium moniliforme*). (Apparently unknown on padi in Malaya).

(5) The germination of all single plant seed in glass bottles, each containing a waxed numbered label, prior to sowing.

(6) The good growth of seedlings in the general nurseries. Seedlings are watered with ammonium sulphate solution about a week before transplanting. This appears to give a remarkable stimulus to their growth, particularly if the rain is late.

(7) The preparation of seed-beds and sowing of single plant cultures. The beds are prepared with very great care to a size of 4 ft. x 3 ft. Each bed is divided from its neighbour by a partition of mud, and a small drain is formed between each row of beds. Before the seed is sown, the nursery beds are flooded to a depth of about two inches and each bed is numbered with a metal label. Bottles containing the germinated seed and waxed numbered label are distributed to the appropriate beds and the seed sown by reliable assistants. At the time of visiting, a dozen labourers were occupied in preparing nursery beds, and ten skilled assistants were sowing seed. It was stated that, by this organization, 800 single plant lots could be sown in about three hours with practically no chance of error.

(8) The slashing and incorporation of green-manures by ploughing and the harrowing and levelling of the land were noted.

(9) A number of species of rice other than *O. sativa* were seen growing together with interspecific crosses and with various abnormal plants (haploids, triploids and polyploids) which were being grown in connection with investigations into chromosomal irregularities.

(10) The growth of mutants (in particular the chlorophyll deficient mutant induced by X-ray treatment of the seed) was noted in the breeding-cage.

Pattambi Sub-station.—This station, with an area of 83 acres, is situated to the west of the Ghats in the Malabar Province about 60 miles from Coimbatore. It consists of a strip of a broad shallow river valley together with some of the higher hill-land adjacent to the valley. The soil is of a lateritic nature, gravelly, shallow and generally deficient in organic matter. It overlies a formation of what appears to be true laterite. The greater part of the station is devoted to padi, but a small portion of the unirrigated high land is occupied by other crops, which, however, are grown mainly in rotation with dry padi.

The buildings, which are particularly well-constructed and maintained, consist of a supervisor's office, a clerical office, a large laboratory, a store, a general work-room, bullock-sheds and the usual outdoor buildings.

The station is divided into four main sections as follows :—

(*a*) Dry land not utilized for padi. There are a few acres devoted to orchard and reserved for later construction of quarters for the staff of the station.

(*b*) Dry land utilized for padi. The higher slopes and the tops of the low hills at the sides of the Stations are utilized for dry padi which is grown once in two or three years in rotation with other crops, thus conforming with the local custom.

(*c*) The terraced and irrigated slopes on which one crop of padi is grown annually between June and October.

TEMPORARY STRAW STACKS FOR STORING PADI USED IN RICE MILLS.

(By courtesy of the Director of Agriculture, Madras.)

NATIVE GRAIN-STORE MADE OF PLASTERED BAMBOO MATS ON A RAISED PLATFORM.

(By courtesy of the Director of Agriculture, Madras.)

(*d*) The low land at the bottom of the valley which has deeper and better soil and is irrigated from the river during the monsoon season. The crops of padi are grown on this land between June and January.

The following features of interest were noted :—

(1) A manurial trial with dry padi. The randomized block system was being used and treatments consisted of dressings of cow-dung at rates of 1,000 lbs., of 3 tons and of 6 tons per acre against an unmanured control. The padi was nearing the flowering stage, but the experiment appeared to be unsuccessful owing to the poor and irregular growth of the crop.

(2) A trial area of pineapples (Kew variety) grown at different spacings and planted in trenches of different depths. This crop is being recommended for inclusion in the rotation with padi.

(3) Trials of sugar-cane grown under differing irrigation.

(4) Several varieties of plantains being grown for inclusion in the rotation with rice.

(5) Investigations into the life-history of *Striga lutea* Lour., a parasitic Angiosperm which commonly grows attached to the roots of hill-padi, with special reference to possible methods of control.

(6) A strip-trial which had been laid out on the terraced irrigated beds to test the difference in yield between broadcast and transplanted padi. Broadcasting seed is a common local custom. Previous trials have shown transplanted padi to be superior to that of broadcast.

(7) The transplanting of seedlings in multiplication blocks on the terraced land which was in progress at the time of visiting.

(8) The transplanting of the general varietal collection which was in progress on the flat land of the Station at the time of visiting.

(9) Strip-trials to test yield of selections against standard varieties had been recently transplanted.

(10) Seedlings for bulk-trials were being transplanted to obtain yield figures of new varieties, and to obtain seed for distribution.

(11) A manurial trial on the wet land was being laid out to determine the effect of varying dressings of lime applied just before transplanting. (Method, randomized blocks; treatments, 500 lbs. 1,000 lbs., 2,000 lbs., of lime per acre and untreated control).

(12) An experiment to determine the effect of spacing on yield. This experiment was duplicated, two varieties of padi being utilized. Spacings on trial were 3 ins. x 3 ins., 6 ins. x 6 ins., 8 ins. x 8 ins. and 12 ins. x 6 ins. The replicated strip method was being used.

(13) An experiment to determine the effect of season on yield of padi. Sowings of padi are being made every three weeks throughout the year in an attempt to correlate meteorological data with yield.

(14) The system of numbering and recording varieties grown. This was kept in the same way as at Coimbatore Station.

General Conclusions on Visit to Madras with Special Reference to Malaya.

1. The area of land under rice in Madras is approximately 11½ million acres and average yield is estimated to be about 1,800 lbs. (equivalent to 330 gantangs) per acre. The rice-area of Malaya is about three-quarters-of-a-million acres and average yields of the best rice-land are similar to those of Madras.

2. One of the most important factors in rice-cultivation in Madras is the seasonal distribution of rainfall. This results in the general popularity of varieties of shorter maturation-period than are common in Malaya though long-term varieties are grown under exceptional conditions.

3. Owing partly to the association of the Rice Research Division of the Department of Agriculture with the Agricultural Section of Madras University, research has for some years been of a fundamental and 'long-range' nature.

4. Among other problems, rice research has been mainly directed towards the study and improvement of cultural practices, methods and effects of manuring, morphological and physiological studies of varieties, general and cytological research, and selection and hybridization.

5. Results of manurial experiments tend to confirm those obtained in Malaya—that in general the use of artificial fertilizers is uneconomical, particularly at the present low price of the crop produced. Attention is being turned towards the growing of green manures in the off-season and satisfactory results are being obtained in this direction.

6. Selection has provided a number of useful varieties capable of giving increased yields of between 8 and 20 per cent. over the unselected varieties formerly grown. Selections of Malayan varieties have given similar increases.

A considerable proportion of the total area of rice land in Madras is now regularly planted with selected strains. About thirty selections are grown commercially and of these eight are grown on a large scale. In addition to increased yield, certain selections give a better quality of rice, a higher proportion of rice to padi, a slightly shorter maturation-period and in several cases, resistance to disease.

7. Hybridization is a comparatively recent development and trials of the hybrids which have been obtained are giving promising results.

8. The readiness of the Madras cultivator to accept new varieties and advice is a noteworthy feature of the agriculture of the country. It is stated to have resulted in a considerable increase in the general average yield of rice throughout Madras during the last two decades.

The writer wishes to record his appreciation of the readiness with which the Director of Agriculture, Madras, granted permisssion to visit Coimbatore, and of the kindness shown and help given by the Padi Specialist and his staff at Coimbatore and Pattambi.

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MILLING TESTS OF PURE STRAIN PADI IN PERAK.

Compiled from information supplied by the Agricultural Staff of the State of Perak and by the Assistant Botanist.

In 1933, attention was drawn in this Journal* to the necessity for improving the quality of locally-produced and milled rice so that it could compare favourably with that of imported rice. One of the conclusions then reached was that the inferior quality of locally-milled rice was due to it being derived from mixed padi, while in the case of imported rice, mixture of types of grain is much less apparent.

Arrangements were accordingly made to have milling tests carried out on recognized strains of padi which, after prolonged experiments in the field, have proved suitable for cultivation in Malaya from the point of view of yield and planting conditions.

The tests were carried out at the Government Rice Mill at Bagan Serai, the first test being made with a mixture of Seraups 36 and 48 and Radin 4. The original intention was to mill the Seraups 36 and 48 together, but owing to a misunderstanding the Radin 4 was included in the mixture. The Radin 4, which is a much smaller grain than the Seraups, separated out unhusked to a considerable extent, and had to be returned to the huller; this undoubtedly affected the amount of breakage in the finished sample.

Three samples of this rice were examined for breakage and gave an average of 23 per cent. of broken rice as compared with 52.5 per cent. from mixed grain, the percentage originally recorded from samples from the same mill in the article already referred to. This analysis, therefore, showed clearly the beneficial effect of a more uniform padi on the quality of the resulting rice.

A further test was made with padi of a single pure strain only, Seraup 48, and the resulting rice gave the satisfactory figure of 15 per cent. broken rice, a considerable improvement on the mixed padi used in the first test.

A third series of milling tests was carried out with seven pure strains of padi, and the table following gives the result of these tests together with the results of the earlier tests for comparison.

From consideration of the results obtained in the third series of milling tests it is evident that such qualities as thorough drying and ripeness of grain are of great importance. This is shewn by the different results obtained with Seraup 36 and Radin 4. No explanation is forthcoming regarding the difference between the two samples of Seraup 36, but the comparative inferiority of the Talang sample of Radin 4 is doubtless due to unevenness in ripening which was a feature of Talang during the season.

* The Characteristics of Malayan Milled Rice, *Malayan Agricultural Journal*, Vol. XXI No. 12, page 674.

Milling Tests of Pure Strain and Mixed Padi.

Series of Tests.	Strain of Padi.	Station of Origin.	Percentage of Breakage.
Original Result	Mixed	...	52.5
First	Seraups 36 and 48 and Radin 4 (mixed).	...	23 *
Second	Seraup 48	...	15 *
Third	Seraup Besar 15	Talang ...	24
	Radin 7	Titi Serong ...	25
	Radin 4	Titi Serong ...	9
	Radin 4	Talang ...	27
	Siam 76	Talang ...	19
	Mayang Ebos 203	Briah ...	19
	Seraup 36	Titi Serong and Bagan	
	- do -	Serai ...	7
	- do -	Kuala Kurau ...	13
	Siam 29	Selinsing ...	6

The opinion is expressed, in connexion with the last series of tests, that better results might have been obtained if the padi had been stored and dried more completely. Support for this view is provided by the excellent result obtained from Siam 29 which had been stored much longer than the other strains. The Manager of the mill considered that the rice milled from Siam 29 was fully equal to Siam No. 1 rice, and a sample of the latter gave 8 per cent. breakage as compared with 6 per cent. recorded above. This result is extremely satisfactory in view of the steps now in progress to endeavour to get this strain planted extensively in South Krian.

In view of the satisfactory results of the milling tests described above it was decided in February, 1935, to approach the Board of Directors, Government Rice Mill, Bagan Serai, with a proposal that the mill should pay a small

* These percentages were obtained as an average of separations carried out with the Colis Separator; the breakage percentage of the Seraup 48 in the second test by hand-picking was 20. The percentages given for the third test were all obtained by hand-picking.

premium for reasonably large quantities of approved pure strains of padi. As a result the Board agreed to pay a premium in 1936 of half a cent a gantang above the current market price to an approved land owner, provided he undertook to plant up that portion of his estate suitable for the particular strain of padi in question, and that he offered the whole of his resultant crop, less what would be required for seed purposes the following season, to the Government Rice Mill, Bagan Serai. The Board also agreed that if owners of small areas of padi land in blocks of reasonable size would agree to the same terms, they too would be entitled to the same premium for unadulterated supplies of pure strain padi.

Negotiations with land owners were commenced and contracts drawn up on these lines; as a result, the owner of 1,000 acres in North Krian has arranged for 700 acres of his land to be planted with Seraup 48.

A similar agreement has been entered into with five Malay padi planters in the Kuala Kurau mukim of Krian, who have planted a total of 56 acres with the same strain of padi (Seraup 48).

In both instances the seed was supplied by the Department of Agriculture at local market prices. It was hoped that similar arrangements could be made with padi planters in South Krian for the planting of reasonably large blocks of land with Siam 29, a variety suitable for the higher lands of this district, but it was found that the majority of planters in this locality had already arranged for their seed supplies, and that it was too late in the season to make satisfactory arrangements. However, if the present experiment proves successful, it should encourage further distribution in 1936, when the fact becomes known that the crop of certain cultivators is commanding a premium.

EFFECT OF SODIUM CHLORATE USED AS A WEED-KILLER AMONG OIL PALMS

BY

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Agriculturist
and
T. D. MARSH,
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The use of sodium chlorate as a weed-killer has attained much prominence in horticultural practice in Europe within the last few years, with the result that consideration has been given to its employment for the destruction of weeds and cover crops, found to be harbouring rats, on oil palm estates in Malaya. As a result of enquiries as to the possible ill-effects of this chemical on the palms, a simple experiment was laid down at the Central Experiment Station, Serdang.

An area of 4 acres of ten-year-old oil palms in Block 21 was selected for this purpose. Owing to the presence of a hard pan at a depth of 2 to 3 feet below the surface the palms in this area are not in a vigorous condition; they were used in this experiment as they would be more likely to show the ill-effects of plant poison than would more vigorous healthy palms.

The experiment was conducted with four plots of one acre each, with palms planted 28 ft. x 28 ft. triangular, *i.e.* 64 palms per acre.

Plots (1) and (2) were clean weeded two weeks before the dressings were applied, while plots (3) and (4) were left under a grass and fern cover.

Series A—Light and Medium Dressings.

In the first series of experiments with light and medium dressings, the following mixtures were sprayed on the four different plots:—

(a) *Clean Weeded Plots.*

Plot (1) sprayed with 4 lbs. sodium chlorate in 32 galls. water.
Plot (2) sprayed with 8 lbs. sodium chlorate in 32 galls. water.

(b) *Unweeded Plots.*

Plot (3) sprayed with 4 lbs. sodium chlorate in 32 galls. water.
Plot (4) sprayed with 8 lbs. sodium chlorate in 32 galls. water.

The plots were sprayed on the 13th and 14th December, 1934, and spraying was repeated with the same concentrations on the 14th January, 1935.

Rainfall.—A table is attached giving rainfall during December, 1934 and January, 1935. These records show that 0.62 inches fell on the 14th and 1.23 inches on the 18th December, 1934. No rain fell after the second dressing until nearly one week had elapsed when 0.16 inches fell on the 19th and 1.58 inches on the 20th January, 1935. It is presumed that a fall of rain approximating to one inch after each spraying would distribute the poison through the soil.

Results.—On all the areas, no apparent damage to oil palms could be observed from the 4 lb. or 8 lb. dressings, and even "supplies" that had their leaves sprayed did not show any signs of browning.

The grass was "scorched" brown after the first dressing, and more so after the second dressings on both series of plots. Ferns, while scorched a little on the edges of the fronds, were not killed or seriously damaged by 4 or 8 lb. dressings.

Conclusions.—Two applications of sodium chlorate at an interval of one month applied up to 8 lbs. in 32 gallons of water per acre have no apparent deleterious effect on mature or immature oil palms. These observations were made six weeks after the second dressing of sodium chlorate was applied.

Series B—Medium and Heavy Dressings.

As the oil palms showed no ill-effects from the first two dressings it was decided to repeat the experiment on the same area with 7 lb. and 14 lb. dressings with different concentrations in each case instead of dressings of 4 lbs. and 8 lbs. in the same volume of water as applied in the first series of experiments.

In the second series of experiments with medium and heavy dressings, the following mixtures were sprayed on the various plots:—

(a) *Clean Weeded Plots.*

Plot (1) sprayed with 7 lbs. sodium chlorate in 25 gallons water.

Plot (2) sprayed with 7 lbs. sodium chlorate in 50 gallons water.

(b) *Unweeded Plots.*

Plot (3) sprayed with 14 lbs. sodium chlorate in 25 gallons water.

Plot (4) sprayed with 14 lbs. sodium chlorate in 50 gallons water.

The first application was made on the 1st and 2nd March, 1935, and the second on the 1st April, 1935.

At the time of treatment on 1st March the grass on Plot (3) was fairly green and had almost recovered from the effect of the previous dressings.

The grass in Plot (4) was recovering, but the growth was not so vigorous as that on Plot (3).

Heavy rain fell on the evenings of the 2nd, 4th, and 5th March, 1935, and observations made on the 7th March showed that scorching effect did not appear so severe as that caused by the earlier dressing on Plots (3) and (4), *i.e.* those applied in December, 1934 and January, 1935. A table showing the rainfall for the period March/April is appended for reference.

Observations made on the weed growth at the end of April showed that on Plot (3) the grass was all scorched brown, but green patches were re-appearing at this stage. On Plot (4) the grass over the whole area still showed a scorched appearance and was recovering only to a very slight extent. The fern growth on Plot (3) presented a ragged and semi-scorched appearance, but on Plot (4) it was struggling to keep alive and much of the foliage had been killed outright; the roots, however, were little affected since young fronds

were then growing. It is significant that the scorching effect of the lower concentration on Plot (4) compared with Plot (3) was much greater and this may be attributed to the better distribution of the spray.

The areas that were clean-weeded in the beginning of December, 1934, had not required any weeding and they were still fairly clean at the end of April, 1935, although the weeds were spreading a little. Between December and April four sprayings were applied.

Further observations made on the 16th August, 1935 or 4½ months after the final dressing, showed that the oil palms had suffered no ill-effects even from the heavier dressings of sodium chlorate.

Although the experiment was primarily designed only to test the possible toxic effects on the palms, the following observations on costs of application and effect on surface growths may be interest.

The cost of the sodium chlorate (99.5 to 100 per cent.) packed in 1 cwt. drums is $19 per cwt., so that a dressing of 14 lbs. of the chemical costs $2.38 per acre.

Four labourers were employed for mixing and spraying the area of 4 acres on each of the four occasions on which the chemical was applied; consequently labour costs are 40 cents per acre for each dressing. It should, however, be mentioned that the precise methods adopted to ensure an even application of the solution to the various plots under experiment would be unnecessary in general estate practice, so that with a resultant larger acreage covered per labourer per day a lowering of costs might be expected.

On the above basis the cost per acre for the respective dressings would be as follows:—

4 lbs. per acre	= 68 cts.	+ 40 cts.	= $1.08	per acre	per dressing.
8 „	= $1.36	+ 40 „	= 1.76	-do-	-do-
14 „	= $2.38	+ 40 „	= 2.78	-do-	-do-

It is estimated that the cost of weeding this area by manual labour would amount to about 60 cents per acre per month, so that the lightest dressing of sodium chlorate—4 lbs. per acre and 6 dressings per annum—would cost about the same as ordinary monthly weeding.

At the end of the experiment weeds and fern growth had become re-established on both the clean-weeded and the unweeded plots.

The maximum effect is apparently obtained when the dressings are applied during dry weather, consequently it is desirable to take advantage of dry seasons so far as possible.

Conclusion.

The experiments prove that two dressings of 14 lbs. of sodium chlorate at intervals of a month have no harmful effect on the growth of oil palms. Further, although Plot (4) in the two series of experiments received a dressing of 44 lbs. of sodium chlorate per acre in the aggregate, the palms in the area showed no ill-effects as a result of this comparatively heavy application.

Records of Rainfall during Sprayings.

Dates.	A-First Dressings of 4 lbs. and 8 lbs. Sodium Chlorate.		B-Second Dressings of 7 lbs. and 14 lbs. Sodium Chlorate.	
	Dec. 1934	Jan. 1935	Mar. 1935	April 1935
	Inches	Inches	Inches	Inches
1	0.10	0.94	0.05	0.05
2	—	—	0.40	—
3	0.18	—	—	0.30
4	—	0.77	0.62	0.07
5	0.35	—	0.35	0.60
6	—	0.08	—	0.13
7	—	1.56	—	0.06
8	—	—	—	—
9	—	—	—	—
10	—	0.01	0.44	1.70
11	—	—	—	0.05
12	—	0.49	0.75	0.06
13	0.02	0.01	0.61	0.75
14	0.62	—	1.12	1.00
15	—	—	1.55	1.41
16	0.01	—	3.57	0.25
17	—	—	1.41	0.30
18	—	—	0.35	0.05
19	1.23	—	0.23	0.02
20	—	0.16	0.80	0.62
21	—	1.58	0.17	0.06
22	0.24	—	—	0.57
23	0.90	—	0.44	0.32
24	0.41	—	0.15	0.15
25	—	—	—	—
26	0.01	—	—	—
27	—	0.50	—	—
28	0.60	—	0.01	0.05
29	—	—	0.07	—
30	0.21	—	—	0.05
31	0.49	—	0.33	—

Danger of Fire with Sodium Chlorate.

It is necessary to issue a warning regarding the properties of sodium chlorate; any clothing or sacking impregnated with a solution of the chemical should be thoroughly washed after spraying, since textiles will be rendered highly inflammable after the spray evaporates.

The liability to an outbreak of fire among the destroyed weeds should also be guarded against by raking the loose dead material into isolated heaps as soon as possible after spraying.

Miscellaneous.

TWENTY-FOURTH REPORT ON NATIVE RUBBER CULTIVATION IN THE NETHERLANDS INDIES.

Third Quarter 1935, with additional data up to the end of October, 1935.*

Prices.

In the early part of the third quarter, the price of Java Standard Sheet in Batavia dropped within a few days from 18½ guilder cents to 17¾ cents per ½ kgm., the latter price level being maintained during the remainder of July. During August, the price improved to 18 cents, after which a decline followed till 16th September, when it reached the low level of 16¾ cents per ½ kgm. Subsequently, a gradual improvement set in till at the end of the month the quotation was 17¾ cents. The half-monthly average quotations during the quarter were—in guilder cents—18.0, 17.8, 18.0, 18.0, 17.4, 17.3. In October, the average reached a considerably higher level, being 18.3 cents for the first half of the month and 19.6 cents for the second half.

Earlier fluctuations were attributed to variations in the stock position, shipments, and exports, in the Netherlands Indies and Malaya. The recovery was caused by the International Rubber Regulation Committee reduction of the export percentage for the last quarter from 65 to 60 per cent., followed by the report of increased American consumption figures. In this connexion also mention should be made of the effect of the acquisition by the Netherlands Indies Government of 20,000 tons of estate licences with a view to compensating for the excess exports of native-grown rubber, and the very determined application of the extraordinary export duties.

The extraordinary export duty was reduced from 21 to 20 guilder cents per kgm. on July 22nd, in view of the declining market prices. On September 30th, increasing prices and the large amounts of native-grown rubber that were being exported, necessitated the raising of the tax to 22 cents per kgm.

The price increase in October was counterbalanced by rises of the extraordinary export duties which rapidly succeeded one another; effective on October 13th, 18th, 23rd and 30th the duty was raised to 23, 24, 25 and 26 guilder-cents per kgm. respectively, the principle followed in each case being that the difference between the market price of Java Standard Sheet in Batavia and the extraordinary export duty (the theoretical basic price) should be kept, as far as possible, constant. In the first few months of the year 10 guilder-cents per kgm. was still being taken as the basic price for working out the extraordinary export duty, but this figure, in view of the large amounts being exported by the native growers in excess of the quota they had been allotted, which quota was still further reduced in the course of the year, had to be brought down to 8 cents in July. For similar reasons the basic price was fixed at 7 guilder-cents for calculating the duty in September. The high

*Abstract from *The Netherlands Indies,* Vol. III No. 24, December 16th, 1935.

exports (17,764 tons) in October made it necessary to reduce the basic price again and on November 10th a price of 6 cents was used in fixing the extraordinary export duty at 29 cents. Beginning with the revision of the extraordinary export duty of June 16th, the time between the announcement of a revision and its going into force was reduced to three days for wet rubber, to two weeks for dry native-made sheets and five weeks for blankets. These so-called "deferment periods" were reduced to 2 days, 12 days and 30 days respectively with the latest increase in the export duty (which took effect on November 11th).

Production and Exports.

The following table shews the monthly production and exports of native grown rubber during 1935.

Production and Exports of Native-grown Rubber during 1935.

Month	Total Exports	Movements of Stocks held by Recognised Exporters	"Corrected" Figures showing Production
January ...	9,817	−3,378	6,539 (Ramadan)
February ...	17,176	−5,260	11,916
March ...	9,025	+1,536	10,561
April ...	13,804	− 675	13,129
May ...	22,588	−3,481	19,107
June ...	14,488	−1,470	13,018
July ...	8,227	+1,290	9,517
August ...	9,870	+1,255	11,125
September ...	9,763	+ 947	10,710
October ...	17,764	−3,400	14,364

The export figures for October shew a sudden rise, which is primarily to be attributed to a considerable clearance of stocks, both visible and invisible, as a result of the reduction of the theoretical basic price from 8 to 7 guilder-cents per ½ kgm. on September 30th. This reduction only became effective for sheets two and blankets five weeks after that date. The clearance, then, principally affected these dry rubber qualities. For this reason, the export figures do not present a correct picture of the production of rubber.

The increased level of production is accounted to the increasing number of small-plantation owners who have begun to participate in the production, as well as to the tapping by those who are dependent on the income they derive from rubber for their livelihood.

Dry rubber is acquiring a constantly higher percentage in the total exports. The remilling factories and the natives themselves are contributing to an approximately equal extent to this development. During the third quarter 10,230 tons were exported by remillers, while the exports of the dry product manufactured by the natives totalled 9,514 tons.

Local Reports.

The following Districts are now under individual restriction schemes:— Acheen and Dependencies, Tapanuli, Sumatra East Coast (excluding Bengkalis), Rhio and Dependencies (Free Area), Bangka and Dependencies. These Districts exported during the quarter 2,755 tons (dry equivalent) of native-grown rubber, 256 tons of which were still subject to the payment of the extraordinary export dues. The exports from January to October inclusive were 780 tons below the allotted amount.

Regions with the extraordinary export duty system are: Sumatra East Coast, Division of Bengkalis; Sumatra West Coast; Rhio, Indragiri; Palembang; Jambi; Western Borneo. Exports from all these areas during the third quarter were appreciably lower than during the previous quarter. In all these districts the activities leading to the registration and classification of rubber trees, with a view to the introduction of the individual restriction system wherever possible, are being pushed energetically.

IMPERIAL FRUIT SHOW, 1935.*

This year the Imperial Fruit Show and Canners' Exhibition which lasted from October 25 to November 2, was held at Cardiff.

The close connexion that exists between the South Wales tinplate industry and the canning side of the fruit and vegetable trade made the choice and locality a very suitable one.

For the main purpose of the Malayan stand, which was, as in previous years, to advertise Malayan pineapples, the dense industrial population in and around Cardiff could hardly have been improved upon.

This was the fifteenth annual show and the most ambitious of the series, embracing every section of the fruit-growing industry in the Home Country, the Dominions, and the Colonies. Producers from all parts of the Empire entered more than 2,000 exhibits for competition in the 122 classes provided, and cash and other prizes to a value of £1,500 were distributed.

The Malayan stand, although the smallest beyond comparison of the Government stands and the only one neither regularly giving nor selling samples, proved very popular. This was chiefly due to the cookery demonstrations given throughout the day, showing the many ways in which pineapples can be prepared for the table. The publicity material, selected in the light of nine years' experience, also proved a great attraction, while the Agency was fortunate enough to secure broadcast mention before the show and considerable publicity during its course in the local press. At the conclusion of each demonstration tasting samples were distributed and pineapple recipes given on request. It would be hard to imagine a more effective means of propaganda among those who form the bulk of the consumers.

Although this is designedly a popular show, chiefly catering for the general public, the stand was visited by a large number of grocers whose enquiries as to prices, qualities, etc. were dealt with and for whom tins were opened on the spot. They were highly impressed by the colour and fine flavour of the "Golden" pineapple displayed on the stand. It was interesting to find, at this Show as at the Grocers' Exhibition, that most of them possessed quite a fair idea of recent developments in the pineapple-canning industry in Malaya, gathered from the Agency's articles in trade papers.

During the current year a good deal of publicity has been secured for Malayan pineapples when it is taken into account that no funds have been available for advertising: a National Broadcast on increasing their use, which elicited some 3,000 letters; stands at one International and one Imperial Exhibition; articles in trade and other publications; and the distribution of 10,000 sets of pineapple recipes.

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*Abstract of Report from the Malayan Information Agency.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports submitted by Field Officers.

December, 1935.

The Weather.

In Kedah, Penang and Province Wellesley the weather was normal for the month, the first half being wet and the second half drier, but the rainfall in Kedah was above average. Elsewhere, with the exception of the east coast, the month was normally wet with some local variations both above and below average precipitation. Thus in Krian and in an area comprising the Tampin District of Negri Sembilan, all Malacca and the northern inland portion of Johore the rainfall was well above average. On the east coast precipitation was slightly deficient in Kelantan, about half the average in the Kuantan and Pekan Districts of Pahang, and even further below normal on the coast of Johore.

Remarks on Crops.

Padi.—Transplanting was completed, with the exception of a few late areas in the Panchang Bedena district. Harvest was completed or in full swing in the riverine padi fields below Kuala Lipis in Pahang, in the Batang Padang District of Perak, the inland Districts of Selangor, the Jelebu District of Negri Sembilan and several parts of Johore. Harvest was commenced in North Kedah, Province Wellesley North, parts of Kuala Pilah and Tampin Districts in Negri Sembilan and part of the Alor Gajah District in Malacca.

Crop prospects in general remain good, except in the Central District of Province Wellesley and in most parts of Johore; in both, weather conditions early in the season were not favourable, while in Johore rats and birds did serious damage. Continuous rains during the month in Krian have resulted in rather deep water in the padi fields and if the rains continue there is danger that part of the crop will lodge. In the new irrigation area of Sungei Manik the crop is reported as very promising, while in the Panchang Bedena area some 7,000 acres are reported to have been planted, with further late areas not yet planted. In this recently developed district rats are very numerous and there is a danger that they may cause considerable damage, in spite of the efforts to reduce their numbers made by the Rat Destruction Officers and the local growers.

In Kelantan good, but not excessive, rainfall has much improved the condition of both the wet and the dry padi crops, and yields are expected to be good.

The Temerloh mill obtained only sufficient supplies of padi to work for one day, but further supplies are expected to be forthcoming now that the harvest is nearly completed.

Organized hunting of wild pig has materially reduced the losses of padi caused by these animals in the Temerloh District of Pahang.

Rubber.—It was reported from most parts of the country that during the greater part of the month there was a further marked reduction in the number of small holdings in tapping. This was due mainly to exhaustion of coupons, but contributing causes were wet weather, padi harvest in some localities and the incidence of the fasting month. Towards the end of the month tapping was renewed in some areas in anticipation of the fresh issue of coupons due at the commencement of next year.

Attempts are being made in the inland Districts of Pahang to obtain for small-holders a greater difference in price between No. 1 and lower grades of rubber sheet and at the same time to demonstrate to small-holders the existence of these various grades of sheet rubber, the ultimate object being, with the assistance of the dealers, to make the sale of lower grades unprofitable. For this purpose the Rubber Supervision Licensing Boards now require that each dealer should exhibit a signboard showing the Singapore or local price, together with samples of the different grades of rubber and the difference in the price of each below that of Singapore standard sheet.

Copra.—There was a further slight rise in the price of copra during the month, but apart from this the situation showed no change from that described for the previous month.

Pineapples.—In Johore adequate fruit supplies were available and five factories continued to operate. A fairly large export to Singapore was also maintained. Prices for fresh fruit declined slightly, but remained attractive. They were for 1st quality $2.20 to $3.50, for 2nd quality $1.60 to $2.90 and for 3rd quality 70 cents to $2.50 per hundred.

In Johore, over considerable areas, pineapples interplanted in rubber continue to be uprooted as the main crop reaches maturity. On the other hand, there is considerable demand for land for the cultivation of pineapples as a sole crop.

Fruits.—In Province Wellesley there were light crops of rambutans and mangosteens sufficient only for local consumption. Durians were in season in Perak North, Selangor, Kuala Lipis District and Southern Johore. Mangosteens were also in season in Perak North, dukus in Johore North and rambutan, rambai, mata kuching, langsat, mango and quini in the inland parts of Pahang.

Interest in fruit planting appears to be well maintained in Pahang. It is reported that some 32 acres of fruit trees have been planted during the year in Kuantan District and that planting material of chikus, citrus and rambutan has been imported into the Pahang East Circle from Trengganu.

Agricultural Stations and Padi Test Stations.

Transplanting was completed on the Sungei Manik Padi Station, where recently constructed bunds have greatly improved water control. Transplanting was also completed on the Sungei Blat Test Station in Pahang and the Lumapas Plot in Brunei, while much of this work was also done on the padi area at the Agricultural Station in Labuan.

Harvesting of early maturing strains commenced on the Telok Chengai Station in Kedah. Heavy showers and winds caused some lodging of the strains Nachin 10, Siam 29 and Reyong 20 at this Station, but the water was quickly drained off so that little, if any, loss of grain is anticipated.

Harvest was in progress on the Kuang and Kajang Test Plots in Selangor, the Jelebu Plot in Negri Sembilan, the Temerloh, Pekan and Bawang Plots in Pahang and the Jemintah Plot in Johore. On the Kuang Plot considerable damage was done to the crop by the Padi Fly (*Leptocorisa* spp.), rats and birds, and at Jemintah heavy rains caused lodging of the weaker-strawed strains.

Agricultural Instruction.

Final judging in the padi sawah competition in the Seremban District of of Negri Sembilan was completed. The results were not as good as was previously anticipated, owing in the main to the fact that very little, if any, attention was given to most padi fields during the recent fasting month. Despite this somewhat disappointing result some entrants maintained their keenness throughout the competition, especially in the mukims of Rasah and Labu.

A demonstration, similar to that described in this article for last month, was given to headmen from the Selinsing, Briah and Gunong Semanggol mukims of Krian at the Government Rice Mill, Bagan Serai, on the 16th December.

The State Agricultural Officer, Johore, assisted by members of his staff gave a second demonstration to headmen and padi growers at the Jemintah Padi Test Plot on the 15th December. Some 70 people attended, and support was lent to the demonstration by the presence of the State Commissioner and the Collector and Assistant Collector of Land Revenue, Segamat. The later-maturing strains of padi were examined, and the use of the sickle for reaping, the barrel for threshing and the winnowing machine were demonstrated.

DEPARTMENTAL NOTES.

Tours of the Adviser on Agriculture.

The Adviser on Agriculture toured the Districts of Kuala Kangsar, Larut, Upper Perak, Krian, the Dindings, and the sub-Districts of Selama and Parit between 2nd and 9th December. During his tour he conferred with the Hon'ble the British Resident, Perak, with District and other administrative officers, and with Agricultural Officers on matters concerning agriculture within the State of Perak.

Visits were paid to all Agricultural Stations, the Government Rice Mill, Bagan Serai, and to a number of Padi Test Stations and school gardens.

On 15th and 16th December, the Adviser visited Singapore for the purpose of inspecting pineapple factories. On 16th he presided at a joint meeting of the Pineapple Advisory Committees for Singapore, Johore and Selangor.

Leave.

Mr. J. A. Craig, Agricultural Officer, has been granted 5 months and 12 days leave from 20th December 1935 to 31st May, 1936.

Mr. J. A. Baker, Agricultural Officer, has been granted 8 months leave, from 8th January to 7th September, 1936.

Mr. C. L. Newman, Agricultural Officer, returned from leave on 20th December, 1935, and assumed duty in the post of Agricultural Officer, Singapore.

Mr. F. Birkinshaw, State Agricultural Officer, Perak, returned from leave on 2nd January 1936.

Mr. E. A. Curtler, Agricultural Officer, Cameron Highlands, returned from leave on 19th December, 1935.

Statistical.

MARKET PRICES.

December, 1935.

Rubber.—The market remained stable during the month, with a slight improvement at the close. Spot loose opened in Singapore at 21¾ cents per lb., rising after the Christmas holidays to close at 22¼ cents. The average price for the month for No. I X. Rubber Smoked Sheet was 21.74 cents per lb. as compared with 21.88 cents in November. The average price in London was 6.33 pence per lb. and in New York 13.05 cents gold as compared with 6.31 pence and 13.08 cents gold in November.

No purchases of small-holders' rubber were made after the beginning of the month, and the following are the only prices reported:— Unsmoked sheet, price per picul; Kuala Pilah, Negri Sembilan, 5th December, $25; Kuala Kangsar, Perak, 4th December, $25; Batu Pahat, Johore, $24.

Palm Oil.—Prices quoted during December for the Malayan commodities are given in the following table.

Table I.

Prices of Palm Oil and Palm Kernels.

Date 1935.	Palm Oil in Bulk, c i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
Dec. 6	21. 0. 0	10. 2. 6
,, 13	21. 0. 0	10 2. 6
,, 20	20. 10. 0	10. 5. 0

Copra.—After a slight weakening at the beginning of the month, the market advanced steadily, and prices improved considerably. The sun-dried grade opened in Singapore at $5.30 per picul, and closed at $5.80, the monthly average price being $5.46, as compared with $5.22 in November. The mixed quality improved similarly, averaging $4.89 per picul as compared with $4.67 in the previous month.

Copra cake fell still further, the price remaining at $1.40 per picul throughout the month as compared with an average of $1.55 in November.

Rice.—The average wholesale prices of rice per picul in Singapore for November were as follows:— Siam No. 2 (ordinary) $3.89, Rangoon No. 1 $3.74, Saigon No. 1 $3.55, as compared with October corresponding prices

of $4.37, $3.86 and $3.82. The corresponding prices in November 1934 were $2.96, $2.95 and $2.92.

The average retail market prices in cents per gantang of No. 2 Siam rice in November were :— Singapore 31, Penang 31, Malacca 27, as compared with 32, 32 and 29 respectively in October.

The average declared trade value of imports of rice in November was $3.66 per picul, as compared with $3.80 in October and $3.59 in September.

Padi.—Retail prices per gantang ranged between 7 and 14 cents.

Tea.—During December five consignments of Malayan tea were sold on the London market; one consignment of highland tea averaged 1s. 0½d. per lb., while the remaining consignments of lowland tea were sold at prices averaging 11½d. and 1s. 0d. per lb.

Average London prices per lb. during the month for tea consignments from other countries were as follows :— Ceylon 1s. 1.47d., Java 1s. 0.55d., Indian Northern 1s. 0.56d., Indian Southern 1s. 0.37d., Sumatra 10.14d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report,* 31st December, 1935, of the Colombo Brokers' Association, and are as follows (rupee cents per lb.) :— High Grown Teas 73 cents, Medium Grown Teas 64 cents, Low Grown Teas 61 cents.

Tuba Root (Derris).—The Singapore market continued dull during the month. Roots sold on rotenone content remained unchanged at $48 per picul, while roots sold on a basis of ether extract declined to $30 per picul from $32.50 in November.

Coffee.—Prices in Singapore weakened during December, Sourabaya coffee falling from $13 to $14 per picul to $12 to $13 at the close. Palembang coffee averaged $7.25 per picul as compared with $7.50 in November.

Locally grown coffee ranged in price from $10 to $30 per picul in various parts of the country.

Arecanuts.—Average prices per picul in Singapore were :— Splits $5.25 to $6.68, Sliced $6.88 to $8.44, Red Whole $4.50 to $6.63, shewing little change in comparison with November.

The Singapore Chamber of Commerce average prices per picul were :— Best $6.40, Medium $5.94, Mixed $5.21.

Gambier.—The price of Block weakened slightly in the second half of December, but the monthly average was $6.75 per picul as compared with $6.60 in November. No. 1 Cube remained at $10 per picul throughout the month; the previous month's average price was $10.10.

Pineapples.—The prices per case fixed by the Packers' Combine were reduced still further to: Cubes $3.55, Sliced Flat $3.35, Sliced Tall $3.50. The November average prices were: $3.99, $3.61 and $3.78.

In Singapore fresh fruit prices per 100 were :— large $3.30 and small $2.50. Prices in Johore were :— 1st quality $3 to $4, 2nd quality $2 to $3, 3rd quality $1 to $2.

Tapioca.—Prices in Singapore weakened further at the close of the month. Average prices per picul were: Flake Fair $5.69, Seed Pearl $5.69, Medium Pearl $6.50, as compared with $5.90, $5.90 and $6.80 in November.

Sago.—Pearl, Small Fair, remained unchanged at the November closing price of $3.75 per picul, as compared with that month's average of $3.95. Flour, Sarawak Fair, fell further, averaging $2.59 per picul as compared with $2.83 in November.

Mace.—Siouw fell to $100 per picul, at which level it remained throughout the month, as compared with an average price of $117 per picul in November. Amboina rose to $70 per picul as compared with $65 in the previous month.

Nutmegs.—There was a slight improvement in the Singapore market at the close of December but average prices for the month were lower than those of the previous month. They were (per picul) 110's $34.50, 80's $35.50, as compared with $36 and $37 in November.

Pepper.—Nominal Singapore prices per picul were: Singapore Black $9, Singapore White $16.50, Muntok White $17.00.

Cloves.—Nominal prices in Singapore during December for both Zanzibar and Amboina were $37.00 per picul.

Cardamoms.—Green cardamoms were quoted during December in the Ceylon Chamber of Commerce weekly reports at 98 rupee cents to R. 1.15 per lb. falling at the close to 95 rupee cents to R. 1.05.

Tobacco.—Prices per picul were as follows:— 1st quality, $28 to $35, 2nd quality $24 to $28, 3rd quality $11 to $20. In Kuala Lipis the range was $64, $40 and $20, and in Port Dickson, Negri Sembilan, abnormally high prices were recorded, the range being $80 to $85, $70 to $75, $50 to $55.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross. London, S.W.1.

GENERAL RICE SUMMARY.*

November, 1935.

Malaya.—Imports of foreign rice during November were 53,373 tons; exports were 15,575 tons, net imports being 37,798 tons. The total of net imports for the period January to November, 1935, was 445,747 tons, an increase of 7.8 per cent. as compared with 413,344 tons in 1934.†

Of the November imports, 56 per cent. were consigned to Singapore, 15 per cent. to Penang, 8 per cent. to Malacca, 15 per cent. to the Federated Malay States and 6 per cent. to the Unfederated Malay States. Of the total, 68 per cent. came from Siam, 24 per cent. from Burma, 6 per cent. from French Indo-China, and 2 per cent. from other countries.

Of the exports during November, 72 per cent. were consigned to the Netherlands Indies, and 28 per cent. to other countries. The various kinds of rice exported were: Siam 12,229 tons (78.5 per cent.), Burma 2,054 tons (13.2 per cent.), French Indo-China 648 tons (4.2 per cent.), parboiled rice 542 tons (3.5 per cent.), local production 102 tons (0.6 per cent.).

India and Burma.—Foreign exports for the period January to October, 1935, totalled 1,519,000 tons, an increase of 20.9 per cent. as compared with 1,256,000 tons in 1934. Of the 1935 exports 3.9 per cent. were to the United Kingdom, 9.9 per cent. to the Continent of Europe, 25.0 per cent. to Ceylon, 31.9 per cent. to the Straits Settlements and the Far East, and 29.3 per cent. to other countries. The corresponding 1934 percentages were: 8.7, 18.8, 24.5, 19.7 and 28.3.

Burma's total exports of rice and bran (*Bangkok Times,* 21st November, 1935) from 1st January to 2nd November, 1935, aggregated 3,132,308 metric tons, as compared with 3,426,348 metric tons in 1934, a decrease of 8.6 per cent.

Siam.—Exports of rice and rice products from Bangkok during October were 142,818 tons (provisional). The cumulative total for the year is 1,260,987 tons, as compared with 1,528,997 tons in 1934.

Japan.—According to *The Trans-Pacific Journal* dated 21 November 1935, the supply and demand relations of rice for the year 1 November 1935 to 31 October 1936, on the basis of the second crop production and the stocks of rice at the end of the last year, have been estimated as follows:—

Supply:	Stocks on 31 October, 1935 ...	1,394,110 tons
	1935 rice crop (second prediction) ...	8,002,805 „
	Estimated imports of Korean rice for 1935-36 rice year ...	1,262,272 „

* Abridged from the Rice Summary for November, 1935, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1934.

	Estimated imports of Formosan rice for 1935-36 rice year ...	701,262 tons
	Total ...	11,360,449 „
Demand:	Total consumption for 1935-36 rice year	9,957,924 „
	Estimated exports of rice ...	64,516 „
	Total ...	10,022,440 „
Stocks:	On 31st October, 1936, the between-season	1,338,009 „

French Indo-China.—Entries of padi into Cholon during the first eleven months of the year totalled 1,558,249 metric tons, as compared with 1,471,113 metric tons in 1934, an increase of 5.9 per cent. Exports of rice for the same period were 1,663,910 metric tons, an increase of 16.4 per cent.

Ceylon.—Imports for the first eleven months of 1935 amounted to 485,772 tons, as compared with 432,253 tons in 1934, an increase of 12.4 per cent.

Of these imports 12.8 per cent. were from British India, 67.2 per cent. from Burma, 0.8 per cent. from the Straits Settlements, and 19.2 per cent. from other countries. The corresponding percentages for 1934 were 13.8, 61.8, 1.7 and 22.7.

Europe and America.—Shipments from the East to Europe during the period 1st January to 21st November, 1935, aggregated 714,397 tons, as compared with 1,130,222 tons in 1934, a decrease of 36.8 per cent. Of these shipments 45.4 per cent. were from Burma, 3.3 per cent. from Japan, 44.3 per cent. from Saigon, 5.5 per cent. from Siam and 1.5 per cent. from Bengal. The 1934 corresponding percentages were 34.4, 4.2, 50.0, 9.5 and 1.9.

Shipments for the Levant from 1st January to 26th October, 1935, totalled 28,458 tons, an increase of 7.0 per cent. as compared with 1934.

Shipments for Cuba, West Indies and America from 1st January to 30th October 1935, amounted to 216,975 tons, as compared with 166,660 tons in 1934, an increase of 30.2 per cent.

MALAYAN AGRICULTURAL EXPORTS, NOVEMBER, 1935.

PRODUCT.	Net Exports in Tons.				
	Year 1934.	Jan-Nov. 1934	Jan-Nov. 1935	November 1934	November 1935
Arecanuts ...	27,336	25,776	19,637	1,936	935
Coconuts, fresh † ...	100,804†	89.787†	97,620†	5,499†	6,997†
Coconut oil ...	25,485	23,138	32,006	2,440	3,736
Copra ...	95,599	86,693	95,455	10,066	11,412
Gambier, all kinds ...	2,170	2,026	2,657	199	217
Oil cakes ...	11,273	10,597	9,855	820	953
Palm kernels ...	3,196	2,771	3,537	147	419
Palm oil ...	15,852	15,055	22,949	1,873	3,516
Pineapples canned ...	66,634	61,793	65,057	2,563	5,898
Rubber ¶ ...	479,371¶	426,871¶	353,175¶	39,591¶	26,444¶
Sago,—flour ...	10,403	8,559	8,490	1,928	545
,, —pearl ...	5,058	4,494	4,267	410	328
,, —raw ...	7,079*	6,326*	6,915*	800*	826*
Tapioca,—flake ...	5,761	5,592	1,800	454	175
,, —flour ..	1,842*	1,786*	605*	130*	81*
,, —pearl ...	15,770	14,345	15,690	1,099	648
Tuba root ...	481	462	519	15	50

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION (IN TONS) OF PALM OIL AND KERNELS

(As declared by Estates)

Month 1935	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S.
January, ...	1,062.3	339.3	174.0	49.6
February ...	977.4	220.9	161.7	38.5
March ...	1,104.3	334.2	172.6	48.6
April ...	1,008.2	328.0	151.2	40.4
May ...	1,077.1	461.8	158.6	63.1
June ...	1,311.0	724.1	200.9	105.5
July ...	1,901.2	729.0	255.3	109.0
August ,, ...	2,331.5	777.9	345.5	120.0
September ...	2,080.0	607.4	231.3	87.7
October ,, ...	1,869.8	512.8	306.5	54.4
November ,, ...	1,464.3	400.5	280.1	58.4
Total ...	16,187.1	5,435.9	2,437.7	775.2
Total Jan. to Nov. 1934 ...	11,839.4	4,106.0	1,861.4	736.8
Total for year 1934 ...	12,965.0	4,510.0	2,013.0	795.0

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 30TH NOVEMBER, 1935.

State or Territory	Acreage of Tappable Rubber end 1934	Estates which have entirely ceased tapping		Estates which have partly ceased tapping (a)		Area of Tappable Rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,691	600	1.3	13,866	31.0	592	1.3	14,466	32.3
Malacca	123,793	1.851	1.5	28,826	23.3	3,461	2.8	30,677	24.8
Penang Island	2,593	Nil	Nil	394	15.2	123	4.7	394	15.2
Singapore Island	33,312	5,718	17.2	7,549	22.7	620	1.9	13,267	39.9
Total S.S. ...	204,389	8,169	4.0	50,635	24.8	4,796	2.3	58,304	28.8
FEDERATED MALAY STATES :—									
Perak	295,895	10,661	3.6	61,354	20.7	11,961	4.0	72,015	24.3
Selangor	345,100	10,822	3.1	64,106	18.6	12,477	3.6	74,928	21.7
Negri Sembilan	258,381	10,389	4.0	48,065	18.6	13,296	5.1	58,454	22.6
Pahang	75,912	10,100	13.3	22,037	29.0	12,551	16.5	32,137	42.3
Total F.M.S. ...	975,288	41,972	4.3	195,562	20.1	50,285	5.2	237,534	24.4
UNFEDERATED MALAY STATES :—									
Johore	417,633	18,282	4.4	66,047	15.8	33,965	8.1	84,329	20.2
Kedah	199,180	3,880	1.9	22,423	11.3	19,349	9.7	26,303	13.2
Kelantan	28,891	403	1.4	8,964	31.0	4,560	15.8	9,367	32.4
Trengganu (b)	4,643	Nil	Nil	15	0.3	5	0.1	15	0.3
Perlis (c)	1,206	Nil	Nil	395	32.8	25	2.1	395	32.8
Brunei	(d) 4,991	Nil	Nil	1,665	33.4	842	16.9	1.665	33.4
Total U.M.S. ...	656,544	22,565	3.4	99,509	15.2	58,746	8.9	122,074	18.6
TOTAL MALAYA ...	1,836,221	72,706	4.0	345,706	18.8	113,827	6.2	418,412	22.8

Notes:—(*a*) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(*b*) Registered Companies only.
(*c*) Rendered quarterly.
(*d*) Acreage of tappable rubber on 1st May, 1934.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF NOVEMBER, 1935, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		Jan. to Nov. inclusive 1935		during the month		Jan. to Nov. inclusive 1935						
	Ports	Dealers	Estates of 100 acres and over	during the month	January to Nov. inclusive 1935	during the month	January to Nov. inclusive 1935	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to Nov. inclusive 1935
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	8,932	10,300	10,604	122,174	3,282	64,644	Nil	Nil	17	Nil	10,789	3,504	*151,989 †140,039	43,209	...	7,953	10,864	8	99
Johore ...	..	1,884	3,655	3,743	45,126	1,866	34,691	Nil	12	Nil	168	2,167	3,513	27,945	50,775	...	1,657	3,823	...	...
Kedah ...	...	319	2,300	2,494	27,995	766	10,448	Nil	Nil	Nil	Nil	1,263	1,738	16,492	20,841	...	299	2,579	...	...
Perlis ...	...	34	11	12	118	15	208	Nil	Nil	Nil	Nil	Nil	44	Nil	337	...	17	11	...	...
Kelantan ...	...	488	274	298	3,644	399	5,375	Nil	Nil	Nil	Nil	183	609	1,909	6,777	...	393	274	...	...
Trengganu ...	...	55	50	251	2,920	126	1,461	Nil	Nil	Nil	Nil	Nil	377	Nil	4,381	...	55	50	...	...
Brunei	...	11	38	60	569	66	661	...	...	...	...	...	121	...	1,205	...	11	43	...	...
Total Malay States	...	11,723	16,628	17,462	202,546	6,520	117,491	Nil	12	17	168	14,402	9,906	198,335	127,525	...	10,385	17,644	8	99
S. SETTLEMENTS :-																				
Malacca ...	...	2,330	1,021	1,016	13,540	505	7,065	Nil	9,655	Nil	126,406	2,272	Nil	28,857	Nil	...	2,378	1,145	...	...
Province Wellesley	...	1,931	427	439	5,173	206	2,649	Nil		Nil						...	1,989	449	...	...
Penang ...	2,869	5,968	10	15	178	72	1,147	2,240		23,887		6,088		81,302		3,173	6,069	13	...	...
Singapore ...	4,617	24,143	166	144	1,949	50	1,277	8,194		142,261		20,385		243,987		2,911	20,444	169	31	427
Labuan	...	35	Nil	Nil	Nil	15	160	84		955		Nil		Nil		...	25	Nil	...	...
Total Straits Settlements	7,486	34,407	1,624	1,614	20,840	848	12,298	10,518	9,655	167,106	126,406	28,745	Nil	354,146	Nil	6,084	30,905	1,776	31	427
TOTAL MALAYA	7,486	46,130	18,252	19,076	223,386	7,368	120,789	10,518	9,667	167,123	126,574	43,147	9,906	552,481	127,525	6,084	41,290	19,420	39	526

*Ocean shipments from Malaya of rubber directly consigned from the F.M.S.

† Exports of rubber from the F.M.S.

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	7,149	19,652	5,615	4,267	1,382	177
WET RUBBER	804	792	454	136	275	122
TOTAL ...	7,953	20,444	6,069	4,403	1,657	299

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to Nov. 1935
29	30	31
Singapore ...	29,195	363,719
Penang ...	8,928	125,039
Port Swettenham.	4,823	59,862
Malacca ...	201	3,861
MALAYA ...	43,147	552,481

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to Nov. 1935
32	33	34
Malay States ...	24,308	313,609
Straits Settlements	2,629	32,468
MALAYA ...	26,937	346,077

Notes:—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [15] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 24 December, 1935.

METEOROLOGICAL SUMMARY, MALAYA, NOVEMBER, 1935.

Locality.	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B.	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total.		Most in a day. Amt.	Number of days: Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total.	Daily Mean.	Per cent.
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	89.0	72.3	80.7	94	70	84	74	83.5	84.3	12.06	306.3	3.05	26	23	9	7		130.85	4.36	36
Bukit Jeram, Selangor ...	86.9	72.7	79.8	90	71	81	74	82.6	85.1	12.27	311.7	2.52	22	18	2	3		176.65	5.89	49
Sitiawan, Perak ...	87.0	73.3	80.1	89	72	85	75	83.1	84.1	8.87	225.3	1.84	22	19				156.50	5.22	44
Temerloh, Pahang ...	87.1	72.7	79.9	91	71	81	75	84.2	85.5	7.86	199.7	1.75	18	15	3	2		139.90	4.66	39
Kuala Lipis, Pahang ...	87.1	71.6	79.3	90	70	80	73	82.9	83.9	10.10	256.5	1.57	23	21	1	19		152.95	5.10	43
Kuala Pahang, Pahang ...	85.3	74.1	79.7	92	71	79	76	82.7	85.0	18.81	477.8	4.96	24	21	1			147.05	4.90	41
Kallang Aerodrome, S'pore ...	85.5	75.3	80.4	89	73	83	78	81.2	81.0	9.86	250.4	2.57	23	17	5			137.45	4.58	38
Butterworth, Province Wellesley ...	86.1	73.7	79.9	89	72	82	76	83.5	84.8	12.38	314.5	2.19	26	23	1		2	167.25	5.57	47
Bayan Lepas Aerodrome, Penang ...	85.9	73.9	79.9	88	71	82	76	82.4	83.2	10.56	268.2	1.23	26	24	5	1		155.95	5.20	44
Bukit China, Malacca ...	84.6	73.9	79.3	88	72	81	76	82.1	83.2	9.84	249.9	2.39	24	18			1	168.60	5.62	47
Kluang, Johore ...	86.9	71.7	79.3	92	70	80	74	81.4	82.0	5.87	149.1	1.41	20	15	3	6	1	131.10	4.37	36
Bukit Lalang, Mersing, Johore	85.0	72.2	78.6	91	71	76	73	81.2	81.5	9.34	237.2	1.60	20	20	5			152.55	5.09	42
Alor Star, Kedah ...	86.9	73.7	80.3	91	72	83	76	84.7	85.8	7.80	198.1	1.23	22	18	5	1		155.45	5.18	43
Kota Bahru, Kelantan ...	85.0	73.6	79.3	90	72	76	75	82.5	84.2	13.95	354.3	2.14	20	15		1		136.30	4.54	38
Kuala Trengganu, Trengganu	85.0	72.9	78.9	88	71	75	75	81.0	82.9	21.49	545.9	6.63	24	18	2	1		128.05	4.27	36
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	73.0	62.3	67.7	77	61	68	64	71.5	72.1	7.53	191.3	1.13	24	21		23		130.05	4.33	36
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	71.4	58.3	64.9	76	54	67	62	69.3	69.5	14.51	368.6	1.55	25	24				101.65	3.39	29
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	70.3	59.3	64.8	74	58	66	61			15.40	391.2	1.78	25	24				104.45	3.48	29

NOTICE.

Department of Agriculture, S.S. and F.M.S.

The Director of Agriculture invites those interested in agriculture to visit the School of Agriculture, Serdang, the Experiment or Agricultural Stations on which miscellaneous crops are cultivated and the Stations and Plots devoted to experiments in padi growing.

Intending visitors to the School of Agriculture should communicate with the Vice Principal, School of Agriculture, Serdang, Selangor.

The School and the Central Experiment Station are situated at about 14 miles by road from Kuala Lumpur and 5½ miles from Sungei Besi Railway Station where cars are usually available for hire. "Visitors' Days" at the Plantation are on the first and third Wednesdays in each month: visitors are requested to arrive at 8.30 a.m. unless previous arrangements are made; limited accommodation is available in a hostel on the Plantation. All enquiries concerning visits should be addressed to the Senior Assistant Agriculturist, Central Experiment Station, Serdang.

Other Stations and Plots, together with the addresses of Officers to whom enquiries should be sent, are listed below:

Government Experiment Station, Tanah Rata, *Agricultural Officer, Cameron Highlands.*

Coconut Experiment Station, Klang, *The Agriculturist, Department of Agriculture, Kuala Lumpur.*

Government Dairy Farm, Fraser's Hill, *Manager.*

Bukit Mertajam Agricultural Station, *Agricultural Field Officer, Province Wellesley, Butterworth.*

Selama Agricultural Station, *Agricultural Officer, Krian.*

Kuala Kangsar Agricultural Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*

Cheras Agricultural Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*

Rembau Agricultural Station, *State Agricultural Officer, Negri Sembilan, Seremban.*

Kuala Pilah Agricultural Station, *State Agricultural Officer, Negri Sembilan, Seremban.*

Sungei Udang Agricultural Station, *Agricultural Field Officer, Malacca.*

Kuala Lipis Agricultural Station, *State Agricultural Officer, Pahang, Kuala Lipis.*

Temerloh Agricultural Station, *State Agricultural Officer, Pahang, Kuala Lipis.*

Kuantan Agricultural Station, *Malay Agricultural Officer, Pahang East, Pekan.*

Pekan Agricultural Station, *Malay Agricultural Officer, Pahang East, Pekan.*

Pineapple Experiment Station, *Agricultural Field Officer, Singapore.*

Bukit Merah Padi Test Station, *Agricultural Field Officer, Province Wellesley, Butterworth.*

Titi Serong Padi Experiment Station, *Agricultural Officer, Krian.*

Talang Padi Test Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*

Pulau Gadong Padi Experiment Station, *Agricultural Field Officer, Malacca.*

Dong Padi Test Station, *State Agricultural Officer, Pahang, Kuala Lipis.*

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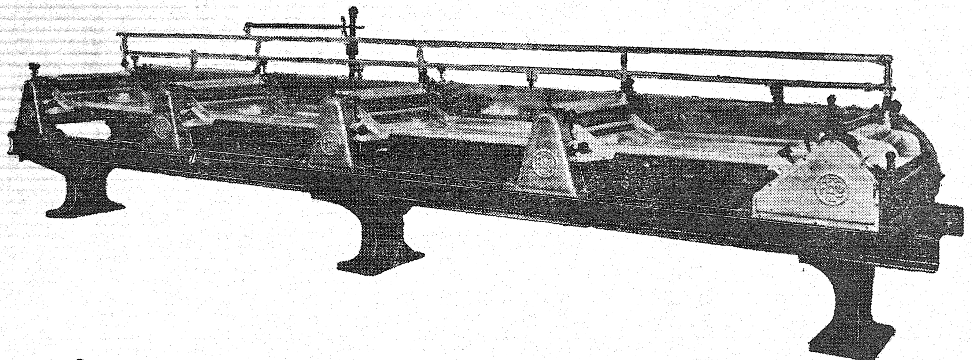

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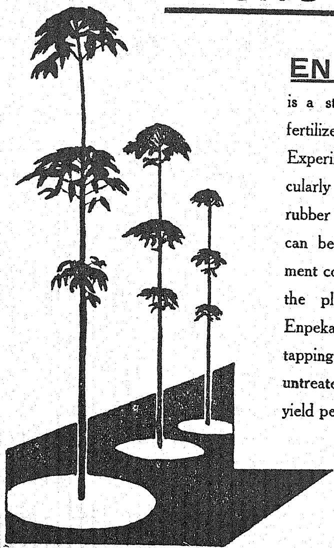

THE

Malayan Agricultural Journal.

FEBRUARY, 1936.

EDITORIAL.

Experiments with Padi.

It has been customary to devote one number of this Journal each year to a detailed review of the rice experiments conducted throughout Malaya during the previous season, together with an account of the economics of the rice supplies during the past year.

On the present occasion we propose to deviate from the usual course, because the magnitude of the task would render this number too bulky and would infer a completeness to which in fact it could lay no claim. No special "rice number" would be complete without inclusion of an account of the progress of the work of the Drainage and Irrigation Department, besides more than passing reference to the work of administrative officers, performed through local economic boards, committees and the local headmen, and to other Departments of Government Service which exercise their influence in different spheres of activity.

Consequently, in the present number, we content ourselves with a presentation of the work of the Department of Agriculture on selection and varietal trials and on the manurial and cultural experiments which have been conducted during the year 1935, and a review of the rice situation in Malaya in 1935.

The rice experiments in Malaya have now advanced to a stage in which the position may appear somewhat complex. Selection work has been continued over a number of years, and the Department has now procured a number of varieties of padi which, under the conditions suitable for each variety, will produce high yields of rice with desirable milling and other qualities. The aim, therefore, is eventually to possess a suitable variety of padi for each main area of padi land. The needs of each district vary considerably; its soils, length of season in which water is obtainable, amount of water;—these factors and others must be taken into consideration in the evolution of suitable types of padi for each set of conditions.

Having evolved the padi variety suitable for a given district, it becomes necessary to persuade the cultivators to adopt it. This, admittedly, is frequently a difficult problem, but patience, demonstration and education are gradually breaking down the barriers, and reports from all the more important centres of rice production refer to the growing popularity of the improved

varieties, the increasing adoption of which is becoming more evident in the heavier yields obtained by the cultivators.

The importance of the industry to the country is fully recognized by the Government, and received emphasis by the appointment in August last of three officers to deal solely with problems arising out of the production of this crop.

While these officers will work on problems related to soils, botany and entomology, the Field Branch of the Department will remain responsible for the general supervision of the rice experiment stations and the carrying out of manurial, cultural and other experiments. Close collaboration between the investigators is effected through the Chief Research Officer and the Chief Field Officer.

It is probable that this re-organization of the investigations will result in a considerable advance of our knowledge of the requirements of the padi crop, which should result, not only in an increase of the area available for its cultivation, but in rendering the crop more profitable—and therefore more popular—amongst the Malay cultivators.

RICE IN MALAYA IN 1935

BY
D. H. GRIST,
Agricultural Economist.

Prices.

The price of rice appreciated considerably during 1935, the average wholesale price by 32 per cent., and the retail by 12 per cent. in comparison with the previous year. Production and stocks in rice-producing countries appear to have been normal, increased prices probably being due less to the stock position than to the improved purchasing power of the consumer coupled possibly with increased handling charges. There was no material change in freight charges to Malaya and no change in local railway rates on rice.

During the latter part of the year the Italian-Abyssinian war, and fears of the widening of the sphere of war, caused a sharp rise in the price of rice owing to the tendency in various countries to ensure adequate stocks. The higher level, however, was not maintained.

The Customs import duty on imports of rice into the Federated Malay States, which was brought into force on 17th October, 1933, was removed on 1st May 1935. The tax was 15 cents per picul of rice, equal to $2.52 per ton. On account of the rising market at the time, the removal of the tax was not noticeably reflected in the retail price of the commodity.

The price of rice has shown considerable fluctuations during the past twelve years. From 1923 to 1929 inclusive, the average wholesale price of Siam No. 2 was $10.10 per picul. In 1930 it dropped to $6.60; thereafter the price steadily declined to $2.91 in 1934, rising to an average of $3.98 in 1935. Rangoon and Saigon rice shewed fluctuations of a similar order.

Details of wholesale and retail prices are stated in Table I.

Imports and Exports.

A statement of the total annual imports and exports of rice with values, for the past seven years, is given in Table II. It will be seen that, in comparison with the previous year, the net imports of rice in 1935 increased by 5 per cent. in quantity, while the cost was $4,849,809 or 20 per cent. greater.

The different grades of rice imported in 1935 were as follows (net imports only are given) :—cargo rice 22,062 tons, parboiled 41,698 tons, white rice 342,635 tons, broken 63,989 tons.

Table I.

Average Prices of Rice and Padi in Malaya, 1935.

Month	Wholesale Price of Rice (Dollars per picul of 133.3 lbs.)			Retail Prices of Rice (Cenrs per Gantang (Gallon)).			Price of Padi per Picul at Gover-ment Rice Mill, Bagan Serai.
	Siam No. 2 (ordinary)	Rangoon No. 1	Saigon No. 1	Singapore	Penang	Malacca	
January ...	3.11	2.89	3.02	22	20	22	1.50
February ...	3.37	3.16	3.32	23	20	22	2.00
March ...	3.77	3.43	3.55	27	20	24	2.00
April ...	3.97	3.41	3.87	28	20	26	1.80
May ...	4.77	3.77	4.05	32	20	30	1.90
June ...	4.34	3.72	3.87	32	23	30	1.90
July ...	4.22	3.77	3.87	32	23	29	2.00
August ...	4.05	3.65	3.62	32	23	29	2.00
September	4.29	3.72	3.77	32	26	29	2.00
October ...	4.37	3.86	3.82	32	32	29	2.00
November	3.89	3.74	3.55	31	31	27	2.20
December	3.62	3.57	3.32	32	30	27	2.00 Nom.
Average for 1935	3.98	3.60	3.64	30	24	27	1.94
Average for 1934	2.91	2.76	2.81	23	24	24	1.42

Table II.

Rice: Malayan Imports and Exports.

Year	Imports		Exports		Net Imports	
	Tons	Value $	Tons	Value $	Tons	Value $
1929	785,558	95,461,036	233,897	28,031,407	551,661	67,429,629
1930	800,443	87,666,723	208,688	23,361,561	591,755	64,305,162
1931	691,112	48,458,102	175,385	13,453,189	515,727	35,004,913
1932	592,209	39,632,925	183,209	12,660,493	409,000	26,972,432
1933	592,912	33,846,158	159,746	9,493,291	433,166	24,352,867
1934	619,199	32,813,558	165,968	8,609,566	453,231	24,203,992
1935	660,020	40,114,794	185,065	11,060,993	474,955	29,053,801

In addition, the net imports of bran, rice flour, and rice meal were 134,722 tons, valued at $3,634,402, as compared with 127,730 tons valued at $3,106,289 in 1934. Adding this product, most of which is used for human consumption, to the above-mentioned imported rice products, the total quantity of rice products imported for local consumption in the year under review amounts to the very large figure of 609,677 tons, valued at $32,688,203 as compared with 580,961 tons, valued at $27,310,281 in 1934. The above does not take into account the net imports of padi, which in 1935 amounted to 5,176 tons, valued at $167,162.

The rice supplies (gross imports) were obtained from the following sources: Siam 397,767 tons (60.7 per cent.), Burma 210,655 tons (32.2 per cent.), French Indo-China 39,338 tons (6 per cent.), other countries 7,084 tons (1.1 per cent.). Of the total imports, 342,502 tons (52.3 per cent.) were consigned to Singapore, 106,929 tons (16.3 per cent.) to Penang, 41,897 tons (6.3 per cent.) to Malacca, 127,452 tons (19.6 per cent.) to the Federated Malay States, and 36,064 tons (5.5 per cent.) to the Unfederated Malay States.

Area Planted.

Early in the season, weather conditions in several areas gave rise to considerable anxiety, particularly in Kedah and the riverine mukims of Perak. In the latter area little damage was done to the crops, but in Kedah heavy floods destroyed the newly planted crop over considerable areas. Replanting became necessary in several places, the Department of Agriculture rendering assistance by the distribution of seedlings. Despite their efforts, nearly 5,000 acres of padi-land failed to reach maturity.

The planted area of "wet" padi was less than in the previous season in all States with the exception of Trengganu, due very largely to the improved economic conditions. The total area planted (669,290 acres) was 4.6 per cent. less than in the season 1933-34.

"Dry" padi cultivation declined from 14,300 acres in the Federated Malay States to 5,160 acres. In the Unfederated Malay States it was fully maintained, being less in Johore, Kedah and Kelantan, but greater in Trengganu.

A summary of the areas and production of padi for the past six seasons is given in Table III.

Production of Padi.

The production of padi per acre in the 1934-35 season compares very favourably with that of the previous season. Comparisons in this respect are difficult as the methods of computation are imperfect. The total estimated yield of wet padi in 1934-35 season was approximately the same as in the previous season, indicating an increased yield per acre, due in large measure to the favourable season, more efficient water control and the extended use of improved seed. The yield of "dry" padi was less favourable than in the previous season, but the total area is not sufficiently large as materially to affect the total production.

Table III.

Areas and Yields of Padi.

Year	"Wet" Padi			"Dry" Padi			Total	
	Area Acres	Yield Gantangs	Gantangs Per Acre	Area Acres	Yield Gantangs	Gantangs Per Acre	Area Acres	Yield Gantangs
1929-30	629,650	103,624,000	164	27,550	3,160,000	114	657,200	106,784,000
1930-31	603,070	166,845,000	277	104,670	9,122,000	87	707,740	175,967,000
1931-32	635,130	184,631,000	291	89,850	12,472,000	139	724,980	197,103,000
1932-33	674,920	186,345,000	276	91,990	13,416,000	146	766,910	199,761,000
1933-34	691,110	215,098,000	311	74,140	9,389,000	127	765,250	224,487,000
1934-35	669,290	213,835,000	319	65,440	6,720,000	106	734,730	220,555,000

(Acreage to nearest 10 acres: yields to nearest 1,000 gantangs)

The total production of rice (both from the "wet" and "dry" systems of cultivation) is given in Table IV and shews that the crop was but a little less than that reaped in the record season 1933-34.

Table IV.

Area of Land Planted in Malaya and Yield of Rice.

Season	F.M.S.		S.S.		U.M.S.		TOTAL	
	Area Acres	Production Rice Tons	Area Acres	Production Rice Tons	Area Acres	Production Rice Tons	Area Acres	Production Rice Tons
1929-31	174,466	47,153	67,005	24,830	415,727	74,985	657,198	152,549
1930-31	178,930	54,257	67,350	37,584	461,460	159,540	707,740	251,381
1931-32	194,580	64,371	67,980	37,701	462,420	179,503	724,980	281,575
1932-33	214,160	72,624	70,530	34,300	482,220	178,449	766,910	285,373
1933-34	195,690	75,006	70,550	42,034	499,010	203,656	765,250	320,696
1934-35	176,750	75,694	68,500	41,851	489,480	197,533	734,730	315,078

(Yield estimated on a basis of 700 gantangs of padi = 1 ton of rice).

The detailed returns from each State are stated in Table V.

Table V.

Area of Land planted in Malaya and Yields of Padi

Season 1934-1935.

State or Territory	Wet		Dry		Total	
	Acres	Gantangs	Acres	Gantangs	Acres	Gantangs
F.M.S.						
Perak ...	89,770	29,347,000	3,220	315,000	92,990	29,662,000
Selangor ...	15,460	4,222,000	730	106,000	16,190	4,328,000
N. Sembilan ...	33,550	10,553,000	230	17,000	33,780	10,570,000
Pahang ...	32,810	8,273,000	980	153,000	33,790	8,426,000
Total ...	171,590	52,395,000	5,160	591,000	176,750	52,986,000
S.S.						
P. Wellesley ...	32,500	13,598,000	570	112,000	33,070	13,710,000
Malacca ...	31,360	13,231,000	—	—	31,360	13,231,000
Penang ...	4,070	2,355,000	—	—	4,070	2,355,000
Total ...	67,930	29,184,000	570	112,000	68,500	29,296,000
U.M.S.						
Johore ...	9,630	1,331,000	2,040	194,000	11,670	1,525,000
Kedah ...	235,580	89,942,000	3,190	629,000	238,770	90,571,000
Perlis ...	40,590	9,482,000	—	—	40,590	9,482,000
Kelantan ...	108,740	25,643,000	31,170	3,961,000	139,910	29,604,000
Trengganu ...	35,230	5,858,000	23,310	1,233,000	58,540	7,091,000
Total ...	429,770	132,256,000	59,710	6,017,000	489,480	138,273,000
Total Malaya ...	669,290	213,835,000	65,440	6,720,000	734,730	220,555,000

Note :—Acreage to the nearest 10 acres.
Yield to the nearest 1000 gantangs.

Consumption compared with Production.

The favourable crops reaped during the past three seasons have stabilized the percentage of production to consumption at about 40 per cent. Consumption in 1935 was about 16,000 tons greater than in the previous year, and about 100,000 tons (14 per cent.) greater than in 1932. That increased production should have been able to maintain the balance between imports and consumption is an achievement. In his last year's review of the situation the writer stated: "With the improvement in trade conditions it cannot be expected that this ratio can be maintained. Consumption is bound to increase still further, and there is difficulty in some districts in mantaining the planted area in view of the attraction which rubber tapping has for the small-holder". The consumption has indeed increased, and the planted area decreased. Increased cost of rice may stimulate local production in some areas. Given a good season in 1935-36, there appears no reason to believe that the ratio of production to consumption or to imports will materially alter, and there appears no reason to believe that the imports of rice in 1936 will show any great increase over those of 1935.

Table VI.
Malayan Production of Rice in Relation to Net Imports and Consumption 1929-1935.

	1929	1930	1931	1932	1933	1934	1935
Net imports (tons) ...	551,661	591,755	515,727	409,000	433,166	453,229	474,955
Production (tons) ...	180,328	152,549	251,381	281,575	285,373	320,696	315,078
Consumption (tons) ...	731,989	744,304	767,108	690,575	718,539	773,925	790,033
Percentage of production to net imports ...	33	26	49	69	66	71	66
Percentage of production to consumption ...	25	20	33	40	40	41	40

Acknowledgments.

The Field Branch of the Department of Agriculture, in collaboration with the Land Officers, were responsible for the estimates of areas and yields as summarized in Table V. The figures for imports and exports, and values thereof, are obtained from the Monthly Summary of Imports and Exports, published by the Statistics Department, Straits Settlements and Federated Malay States, and are subject to minor adjustments at a later date.

PADI SELECTION AND VARIETAL TRIALS 1934-1935.

Compiled by
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Introduction.

This report summarizes the results of selection work and yield trials carried out by the Field Branch of the Department of Agriculture at the various padi stations and test plots in Malaya. Statistical analysis of the results was made by the Research Branch.

During the year under review, five main experiment stations and twenty-eight test plots were maintained by the Department. In addition, two test plots were maintained by the Government of Perlis. At least one station or test plot is situated in each of the important rice-growing districts in the country. The table on the next page, together with the map, shows the distribution of the stations and plots. (One test plot in Brunei is not shown in the map). Results from experiments in the Unfederated States are included by courtesy of the Governments concerned.

The standardized procedure of the previous year* was continued and the general adoption of Latin Squares facilitated the accurate comparison of yields of the strains under trial.

Minimum significant differences—between any two plots—throughout the report are estimated on a basis of Fisher's "t" test for 5 per cent. points. That is to say, the chances of one variety being superior to another in cases where "significance" occurs are at least ninety-five in one hundred.

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* See Report in *Malayan Agricultural Journal* Vol. XXIII, No. 1, January 1935.

The following abreviations are used throughout this report:—

Standard Deviation (S.D.)

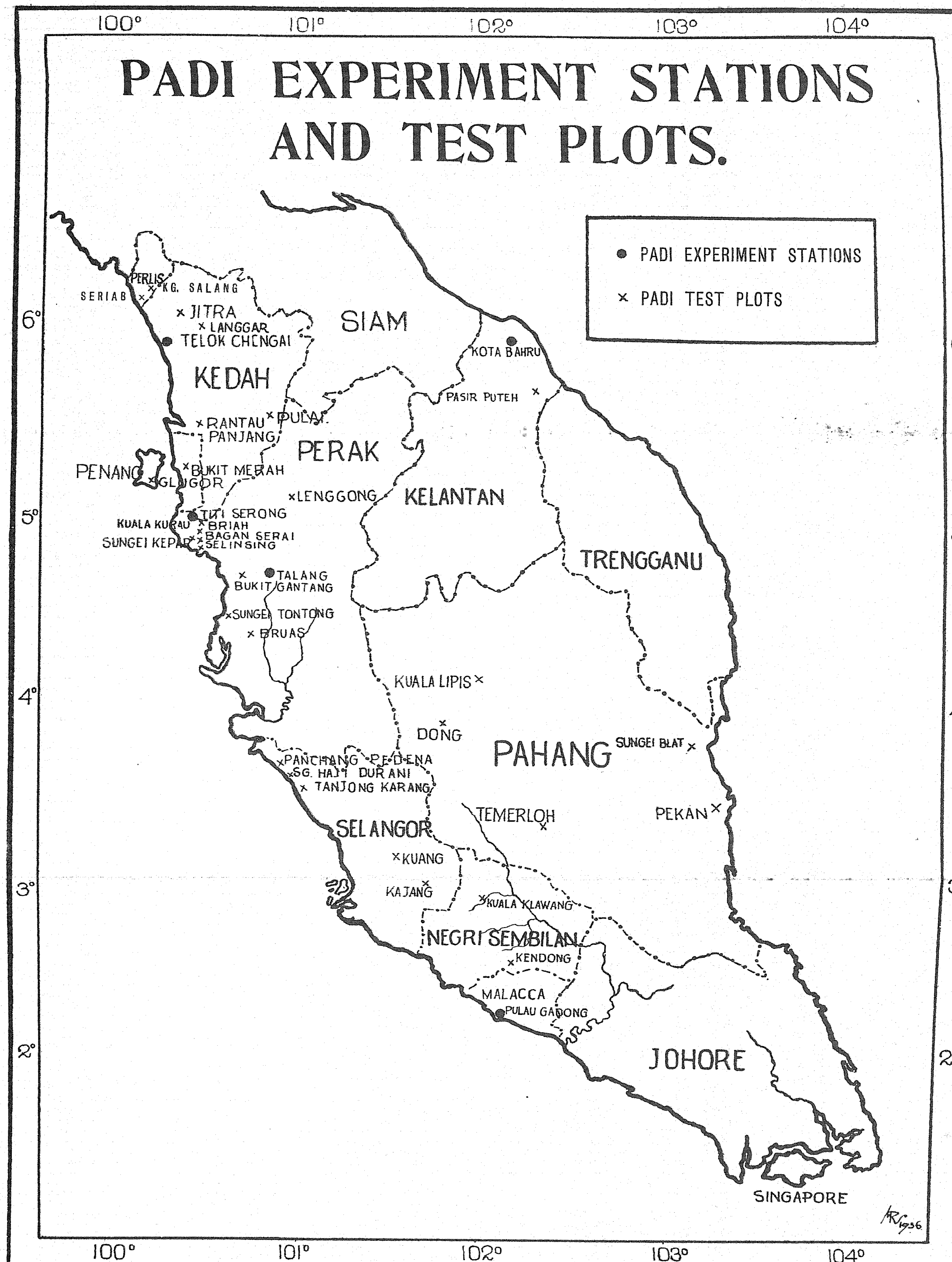
Minimum Significant Difference (M.S.D.)

B	—	Bujang.	R.C.	—	Radin China.
F.S.	—	Foundation Stock.	R.S.	—	Radin Siak.
M.E.	—	Mayang Ebus.	Rey.	—	Reyong.
M.K.	—	Milek Kuning.	Sm.	—	Siam.
M.P.	—	Milek Puteh.	S.B.	—	Seraup Besar.
N.	—	Nachin.	S.K.	—	Seraup Kechil.
R.	—	Radin.	Sr.	—	Serendah.

Distribution of Rice Experiment Stations and Test Plots.

Name of Station or Test Plot.	State.	Locality.
Seriab	Perlis	Kangar
Kampong Salang	"	"
Telok Chengai Experiment Station	Kedah	Alor Star
Langgar Test Plot	"	District of Kota Star North
Jitra Test Plot	"	" Kubang Pasu
Rantau Panjang Test Plot	"	" Kuala Muda
Pulai Test Plot	"	" Baling
Glugor Test Plot	Penang	
Bukit Merah Test Plot	Province Wellesley	South West District
Titi Serong Experiment Station	Perak	District of Krian
Kuala Kurau Test Plot	"	" "
Bagan Serai Test Plot	"	" "
Briah Test Plot	"	" "
Selinsing Test Plot	"	" "
Bukit Gantang Test Plot	"	" Larut
Lenggong Test Plot	"	" Upper Perak
Bruas Test Plot	"	" Bruas
Talang Experiment Station	"	" Kuala Kangsar
Sungei Tontong Test Plot	"	" Dindings
Panchang Bedena Test Plot	Selangor	" Kuala Selangor
Sungei Haji Durani Test Plot	"	" "
Tanjong Karang Test Plot	"	" "
Kuang Test Plot	"	" Ulu Selangor
Kajang Test Plot	"	" Ulu Langat
Kuala Klawang Test Plot	Negri Sembilan	" Jelebu
Kendong Test Plot	"	" Tampin
Pulau Gadong Experiment Station	Malacca	Central District
Temerloh Test Plot	Pahang	District of Temerloh
Dong Test Plot	"	" Raub
Kuala Lipis Test Plot	"	" Lipis
Sungei Blat Test Plot	"	" Kuantan
Pekan Test Plot	"	" Pekan
Central Experiment Station	Kelantan	" Kota Bahru
Pasir Puteh Test Plot	"	" Pasir Puteh
Kilanas Test Plot	Brunei	Borneo.

PADI EXPERIMENT STATIONS AND TEST PLOTS.



Perlis.

Test plots at Seriab and Kampong Salang, both situated within a few miles of Kangar, were maintained by the Government of Perlis under the supervision of a Malay Padi Inspector. Trials in randomized blocks with four replications of each variety were carried out between local unselected varieties and pure strains selected elsewhere in Malaya. The results obtained are shown below.

Table I.

Seriab.		Kampang Salang	
Variety	Mean yield per 1/45th acre in gantangs.	Variety	Mean yield per 1/45th acre in gantangs.
Sm. 29 ...	12.75	R. Seroja (local)	11.17
Sm. 76 ...	12.50	R. Kamuja (local) (3 plots only)	12.47
N. 10 ...	12.81	Sm. 29 ...	14.26
M.E. (local) ...	11.38	R. Pulau (local)	12.73
Rey. 20 ...	14.19	N. 10 ...	14.43
Tok Awang ... (local) ...	12.90	M. Batil (local)	12.67
Mean ...	12.75	Mean ...	12.96
S.D. 2.01 gantangs (15.7% of mean) M.S.D. 2.9 gantangs.		Owing to the loss of crop from one plot, these results were not analysed.	

Kedah.

The station at Sala Kanan was abandoned owing to difficulties of water control. In addition to the Experiment Station at Telok Chengai, test plots situated respectively at Langgar, Jitra, Rantau Panjang, and Pulai were maintained during the season.

Teloh Chengai Experiment Station.

Selection.—The selection work started in the 1931-32 season was continued. Seventy lines of the local variety To' Seman were grown for the second season, and preliminary selections were made from a four-month Indian variety 'Kalyaman' (obtained from Trinidad) and from the two local varieties 'Nakon' and 'Kala'.

Of the earlier local selections, those shown in Table II have proved their worth and may be regarded as "final selections".

Table II.

Strain.	Average yield per plant for the four seasons ending 1934-35.
	grammes
Chubai 18 ...	100.02
M.E. 88 ...	118.03
Radin Che Nah 28 ...	115.78
R.C. 4 ...	111.85
R.C. 17 ...	115.38
Rey. 20 ...	116.18

Selected strains imported from other districts in Malaya have been grown in pure lines for several seasons and the mean weight of grain per plant calculated. Table III shows the mean weight yielded by these strains during the last four seasons. It will be noted that Seraup Kechil 48 gives an outstandingly high yield per plant, but this strain, having a comparatively long maturation period (7 to 7½ months), is unsuitable for normal conditions in Kedah owing to the limited period during which sufficient water is available.

Table III.

Strain.	Average yield per plant for the four seasons ending 1934-35.
	grammes
N. 10 ...	111.83
Sm. 29 ...	109.34
S.K. 48 ...	124.29
S.B. 15 ...	91.25

Varietal Trial.—Certain previous selections were grown in a six-way Latin Square, the size of the plots being 22 ft. x 22 ft. or 1/90th acre. The results of this experiment are shown in Table IV.

Table IV.

Mean Yield per Plot of 1/90th acre in pounds.

Station.	M.E. 88	R.C. 17	Rey. 20	M.E. 90	R.C. 16	Rey. 49
Telok Chengai ...	43.25	44.21	42.1	41.9	45.4	42.7
Mean 43.23 lbs.						
S.D. 1.77 lbs. (4.6% of mean) M.S.D. 2.42 lbs.						

Multiplication.—Twenty-five large plots of imported and local selections were established for supply of seed for distribution and for comparative purposes. There were considerable losses from these plots through accidental causes (chiefly storms and unavoidable delay in harvest) but yields as recorded in Table V were generally satisfactory.

Table V.

Calculated Yield per acre of Large Plots for Local and Imported Selected Varieties.

Variety.	Yield per acre in gantangs.
N. 10 (Malacca) ...	508
Sm. 29 „ ...	563
Sm. 76 „ ...	553
S.K. 48 (Krian) ...	533
S.B. 15 „ ...	445
Sr. 824 „ ...	468
Rey. 6 (Kedah) ...	514
Rey. 20 „ ...	536
M.E. 88 „ ...	461
R.C. 4 „ ...	632
Radin Che Nah 28 (Kedah)	545
Chubai 18 (Kedah) ...	514

Langgar Padi Test Plot.

At this Station four selected varieties and one unselected local variety were tested against each other in a five-way Latin Square, each plot having an area of 1/120th acre. A slight modification of the square was necessary to overcome possible residual manurial effects on a portion of the land which was manured with local guano in the previous season. Table VI shows a summary of the yields recorded.

Table VI.

	N. 10	Sm. 29	Sm. 76	R.S. 7	To' Seman	Mean.
Mean yield per plot of 1/120th acre in lbs. ...	26.46	26.09	23.66	20.15	19.96	23.26

Statistical analysis showed Siam 29, Siam 76, and Nachin 10 to be superior in yield to Radin Siak 7 and the unselected To' Seman.

For comparative purposes a second yield trial of the four selected varieties Nachin 10, Siam 29, Siam 76 and Radin Siak 7 was laid down on a randomized block plan with plots of 1/45th acre. It was shown that a higher degree of accuracy was obtainable with smaller plots and a Latin Square arrangement, as field and harvesting losses are higher in the larger plots.

Table VI (a) shows the comparative yields calculated in gantangs per acre from plots of 1/120th and of 1/45th acre.

Table VI (a)

Strain.	A. Calculated yield per acre from 1/120th acre plots in gantangs.	B. Calculated yield per acre from 1/45th acre plots in gantangs.	Difference between A. and B.	Difference as Percentage of B.
Sm. 29 ...	592	450	142	32
N. 10 ...	577	405	172	42
Sm. 76 ...	489	401	88	22
R.S. 7 ...	415	373	42	11

Jitra Padi Test Plot.

In spite of damage from flooding by the Jitra River and of damage by rats to the comparatively early strain Reyong 20, exceptionally heavy yields (recorded in Table VII) were obtained at this Station. The plots were irrigated, and manured with local guano at a rate of 1,000 lbs. per acre, one month after planting.

Table VII.

	M.E. 88	Sm. 76	R.C. 4	Rey. 6	Rey. 20	M.E. 80
Calculated yield per acre in gantangs. ...	748	723	675	650	599	585
Calculated yield per acre in lbs. ...	4092	4034	3841	3678	3391	3346

Pulai Padi Test Plot.

A satisfactory season was experienced at this Plot where Siam 29, Siam 76, Reyong 20 and Nachin 10 were planted in a randomized block with four replications of 1/45th acre of each variety. The high yields of Siam 29 and Siam 76 are noteworthy.

Table VIII shows the calculated yields obtained.

Table VIII.

	Sm. 29	Sm. 76	Rey. 20	N. 10
Calculated yield in gantangs ...	698	641	602	557
Calculated yield per acre in lbs. ...	3865	3540	3353	2862

Rantau Panjang Padi Test Plot.

Although flooding caused complete submergence of the growing crop for several days on two occasions, recovery was good and very satisfactory yields were obtained. Five selected varieties together with a popular local unselected variety (Anak Kuching) were planted in a randomized block, each variety being represented by six replications of plots, each of 1/45th acre in area.

Table IX shows the calculated yields obtained.

Table IX.

	Sm. 76	Sm. 29	N. 10	Rey. 20	Rey. 6	Anak Kuching (unseleeted)
Calculated yield per acre in gantangs ...	685	682	679	657	613	585
Calculated yield per acre in lbs. ...	3808	3660	3608	3737	3483	3226

Penang and Province Wellesley.

Glugor Padi Test Plot *(Penang.)*

As in past years this Station suffered somewhat from flood damage and stem borers. The programme included four varietal trials arranged in Latin Squares, and preliminary selection of a good local variety known as Sebatil. In the first square (8 months varieties) Seraup Kechil 36 proved significantly superior to the other varieties, while in the second square Nachin 66 was shown to be significantly superior to the other varieties with which it was compared. Table X shows the yields obtained and significant differences.

Table X.

Square A.		Square B.	
Variety.	Mean Yields in lbs. per 1/120th acre.	Variety.	Mean Yields in lbs. per 1/120th acre.
S.K. 36 ...	18.9	Sm. 29 ...	15.1
S.K. 48 ...	16.2	R. 2 ...	14.4
S.K. 68 ...	8.5	N. 66 ...	18.5
Sebatil ...	16.6	R. 4 ...	15.5
Mean ...	15.1	Mean ...	15.9
S.D. 1.25 lbs. (8.3% of mean) M.S.D. 2.17 lbs.		S.D. 1.74 lbs. (9.1% of mean) M.S.D. 3.03 lbs.	

Square C.		Square D.	
Variety.	Yields in lbs. per 1/120th acre.	Variety.	Yields in lbs. per 1/120th acre.
Sr. 824 ...	21.7 (3 plots only)	Sm. 29 ...	15.6
M.E. 203 ...	15.8	R.S. 18 ...	18.0
M.E. 202 ...	17.1 (3 plots only)	R.S. 34 ...	15.0
N. 756 ...	17.3	R.S. 17 ...	17.3
Mean ...	18.0	Mean ...	16.5
Owing to flood damage, no crop was reaped from two plots. The results were therefore not analysed.		S.D. 1.33 lbs. (8.0% of mean) M.S.D. 2.3 lbs.	

Bukit Merah Padi Test Plot *(Province Wellesley.)*

The programme of this Station consisted of multiplication of the selected strains Siam 29, Mayang Ebus 203, Seraup Kechil 48 and Seraup 15; of further selection of the local variety Mayang Ebus; and of five four-way Latin Squares for varietal trials.

The results of these varietal trials (shown below in Table XI) indicate—with due consideration to performance during several successive seasons—that Siam 29, with a calculated mean yield over the past four seasons of 433 gantangs per acre, may be confidently recommended for the Central District of the Province. Mayang Ebus 203 with a calculated mean yield per acre of 381 gantangs during the last three seasons may also be recommended for distribution in this District and in the shallow water areas of Province Wellesley North.

Table XI.

Square A.		Square B.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
Rey. 20 ...	13.6	Sm. 29 ...	15.8
R.C. 4 ...	16.4	N. 66 ...	14.3
Rey. 6 ...	15.4	Sr. 824 ...	14.5
Rey. (local) ...	14.5	N. 756 ...	15.3
Mean ...	15.0	Mean ...	15.0
S.D. 1.5 lbs. (10.0% of mean) M.S.D. 2.6 lbs.		S.D. 0.82 lbs. (5.5% of mean) M.S.D. 1.42 lbs.	

Square C		Square D	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
Sm. 29 ...	16.4	Sm. 29 ...	14.3
N. 66 ...	14.5	N. 66 ...	15.4
M.E. 203 ...	15.9	M.E. 88 ...	15.6
F.S. 63 ...	14.1	Rey. 20 ...	12.1
Mean ...	15.2	Mean ...	14.4
The differences between the means observed cannot be considered significant on statistical analysis.		No analysis of these figures was made as they are very regular and Rey. 20 is obviously inferior.	

Square E.		
Variety.	Mean yield per 1/120th acre in lbs.	Remarks.
M.E. 203 ...	21.1	This square was not analysed as the minimum difference between means is 2 lbs. only. There were several poor plots of M. E. 88 and M. E. (local).
M.E. 210 ...	20.1	
M.E. 88 ...	19.1	
M.E. 80 ...	21.1	
M.E. (local) ...	19.3	
Mean ...	20.1	

Perak.

Titi Serong Experiment Station.

A fairly satisfactory season was experienced at this Station, though the crop generally was not so good as in the previous season (1933-34). Heavy flooding occurred early in September followed by drought at the critical time of flowering early in December.

Selection work was continued on strains of comparatively long maturation period. The strains with shorter maturation periods, previously under selection here, have been moved to Talang Station (Kuala Kangsar) where conditions are more suitable. Strains grown for observation and selection during the season included Mayang Kuning (selections from Kuala Kangsar and Province Wellesley), Mayang Ebus (Province Wellesley), Bujang (local), Mayang, Serbok Mas and Tongkat (from Batu Kurau, Larut) and Seri Menjadi (local). The Kelantan selections (Kemasing and Anak China) proved disappointing in yield trials in spite of a good performance when grown in pure line, and further work on them is not contemplated.

Hybrids.—Twenty-seven lines of hybrids now in the fourth generation were raised, and comprised seventeen lines of the progeny of Radin 2 x Seraup Kechil 36 and ten lines of the progeny of Radin 2 x Nachin 27. During the season five lines were discarded leaving a balance of twenty-two for further observation.

Varietal Trials.—Nine four-way Latin Squares (with sub-plots of 1/120th acre) were established to test comparative yields of selected strains. The results are summarized in Table XII.

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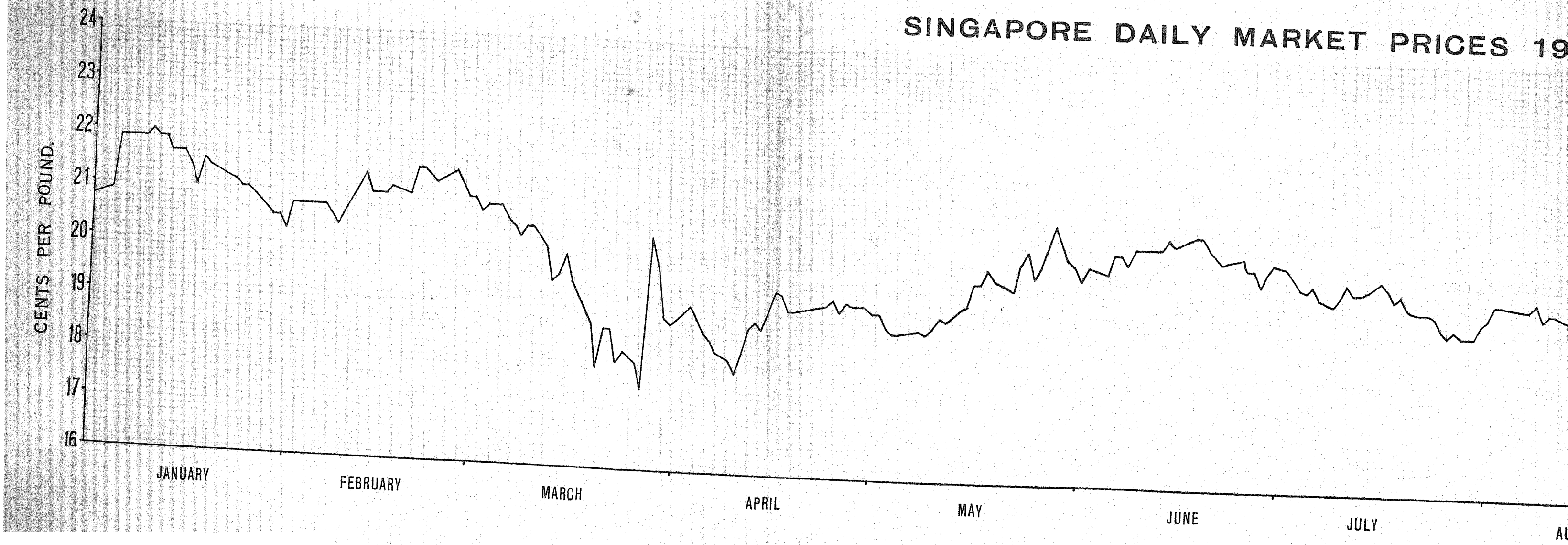
SINGAPORE DAILY MARKET PRICES 19



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GAPORE DAILY MARKET PRICES 1935

Supplement to
The Malayan Agricultural Journal, February 1936.

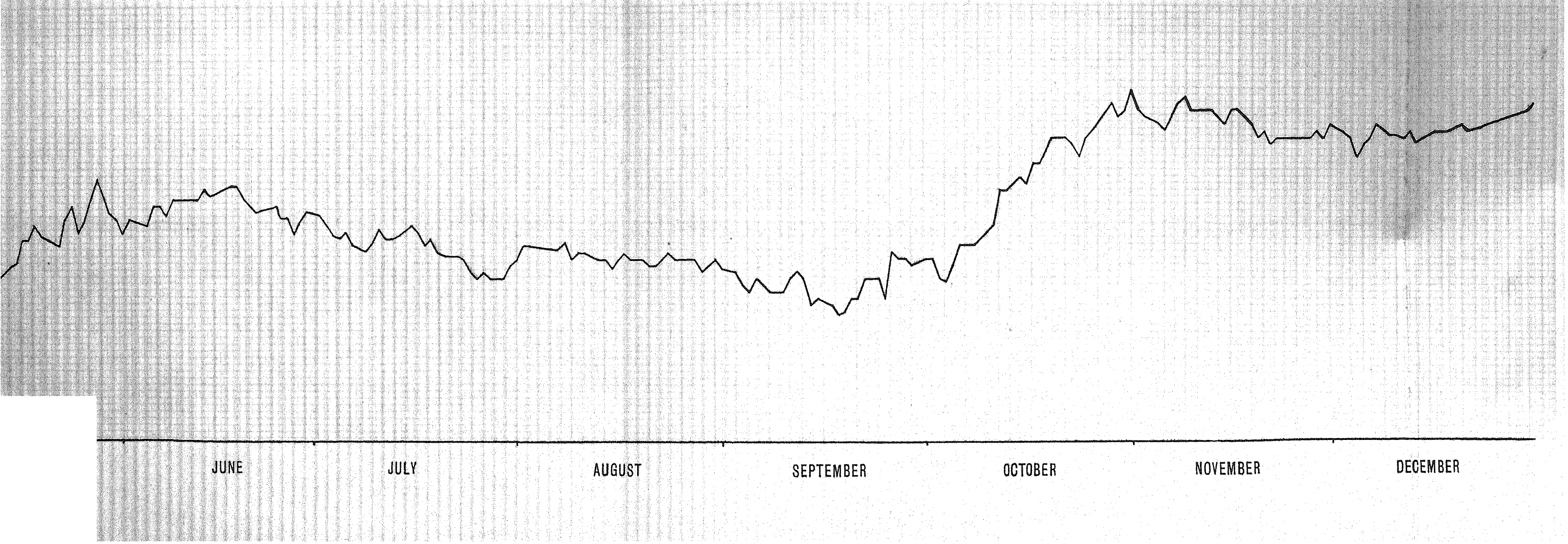

Table XII.

Square A.		Square B.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
S.K. 36 ...	21.4	S.K. 36	20.2
S.K. 371 ...	27.1	S.K. 371 ...	26.5
S.K. 48 ...	21.7	S.K. 48 ...	22.3
S.K. 146 ...	30.1	S.K. 146 ...	28.5
Mean ...	25.2	Mean ...	24.4
S.D. 2.38 lbs. (9.4% of mean) M.S.D. 4.14 lbs.		S.D. 1.22 lbs. (5.0% of mean) M.S.D. 4.14 lbs.	

Squares A and B combined		Square C.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
S.K. 36 ...	20.8	S.K. 48 ...	22.1
S.K. 371 ...	26.8	S.B. 15 ...	23.2
S.K. 48 ...	22.0	S.K. 6 ...	22.8
S.K. 146 ...	29.3	S.K. 68 ...	22.0
Mean ...	24.7	Mean ...	22.5
S.D. 1.37 lbs. (5.5% of mean) M.S.D. 1.48 lbs.		This square was not analysed as there is obviously no significant difference between means.	

Square D.		Square E.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
R. 4 ...	18.9	R. 4 ...	17.8
R. 13 ...	21.0	R. 16 ...	13.3
R. 7 ...	19.7	R. 1 ...	17.3
R. 11 ...	19.5	R. 2 ...	14.8
Mean ...	19.7	Mean ...	15.8
S.D. 2.07 lbs. (10.5% of mean) No significant difference.		S.D. 1.59 lbs. (10.1% of mean) M.S.D. 2.76.	

Square F.		Square G.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
M.E. 209 ...	19.2	B. 215 ...	22.5
M.E. 210 ...	21.2	B. 216 ...	22.3
M.E. 208 ...	20.8	B. 213 ...	22.0
M.E. 203 ...	20.8	B. 212 ...	22.2
M.E. 202 ...	22.1	B. 211 ...	23.0
Mean ...	20.8	Mean ...	22.4
S.D. 1.51 (7.2% of mean) M.S.D. 2.21 lbs.		Not analysed. No significant difference between means.	

Square H. (Kelantan varieties)		Square K.	
Variety	Mean yield per 1/120th acre in lbs.	Variety	Mean yield per 1/120th acre in lbs.
F.S. 369 ...	23.9	F.S. 48 ...	26.4
F.S. 397 ...	20.3	F.S. 55 ...	22.9
F.S. 346 ...	15.4	F.S. 42	22.4
F.S. 341 ...	13.0	F.S. 39 ...	22.8
F.S. 331 ...	20.3	S.K. 48 ...	18.9
Mean ...	18.6	Mean ...	22.7
S.D. 1.77 lbs. (9.5% of mean) M.S.D. 2.58 lbs.		S.D. 2.30 lbs. (10.1% of mean) M.S.D. 3.36 lbs.	

Kuala Kurau Test Plot.

In spite of several periods when weather conditions were unfavourable, a satisfactory crop was obtained at this plot. The programme consisted of four varietal trials of long-term varieties arranged in four-way Latin Squares. The results are shown in Table XIII.

Table XIII.

Square A.		Square B.	
Variety	Mean yield per 1/120th acre in lbs.	Variety	Mean yield per 1/120th acre in lbs.
S.K. 36 ...	25.0	S.K. 36 ...	25.3
S.K. 371 ...	21.9	S.K. 371 ...	27.5
S.K. 48 ...	26.8	S.K. 48 ...	28.6
S.K. 146 ...	21.3	S.K. 146 ...	26.6
Mean ...	23.7	Mean	27.0
S.D. 2.21 lbs. (9.3% of mean) M.S.D. 3.86 lbs.		S.D. 1.95 lbs. (7.2% of mean) M.S.D. 3.39 lbs.	

Squares A and B combined.		Square C.	
Variety	Mean yield per 1/120th acre in lbs.	Variety	Mean yield per 1/120th acre in lbs.
S.K. 36 ...	25.1	S.K. 36 ...	26.4
S.K. 371 ...	24.7	Mayang Sa Gumpal (local)	25.8
S.K. 48 ...	27.7	S.K. 48 ...	27.5
S.K. 146 ...	24.0	Machang (local)	30.8
Mean ...	25.4	Mean ...	27.6
S.D. 2.24 lbs. (8.8% of mean) M.S.D. 2.24 lbs.		S.D. 1.97 lbs. (7.1% of mean) M.S.D. 3.40 lbs.	

Square D. (duplicate of C.)		Squares C and D combined.	
Variety	Mean yield per 1/120th acre in lbs.	Variety	Mean yield per 1/120th acre in lbs.
S.K. 36 ...	27.4	S.K. 36 ...	26.8
Mayang Sa Gumpal (local)	26.1	Mayang Sa Gumpal (local)	25.9
S.K. 48 ...	30.5	S.K. 48 ...	29.0
Machang (local)	30.5	Machang (local)	30.6
Mean ...	28.6	Mean ...	28.1
S.D. 0.83 lbs. (2.9% of mean) M.S.D. 1.45 lbs.		S.D. 1.76 lbs. (6.3% of mean) M.S.D. 1.90 lbs.	

Bagan Serai Test Plot.

This Plot was established during the season under review. The crop was disappointing owing to damage caused by drought at flowering time early in December. Some damage from rats also occurred.

The varietal trials consisted of a duplicated five-way Latin Square of Seraup strains. Results of the trials are shown below in Table XIV.

Table XIV.

Variety.	Mean yield per plot of 1/120th acre in lbs.		
	Square A.	Square B.	Squares A & B combined.
S.K. 36 ...	20.8	23.2	22.0
S.K. 48 ...	20.8	23.0	21.9
S.K. 146 ...	23.5	23.4	23.5
S.K. 371 ...	22.6	23.6	21.3
S.B. 15 ...	21.7	23.1	22.6
Mean ...	21.9	23.3	22.6
S.D. ...	1.15 lbs.	—	1.15 lbs.
S.D. as percentage of mean ...	5.2	—	7.7
M.S.D. ...	1.46 lbs.	No significant differences.	

Briah Test Plot.

Apart from an attack of *Nymphula depunctalis* in the nurseries a highly successful season was experienced at this plot. Floods in September caused no permanent damage and there was sufficient water during the December drought. The varietal trial in the form of a duplicated Latin Square was designed to test the relative yields of four selected varieties against that of one local unselected variety (Alor Star). Table XV summarizes the results.

Table XV.

Variety.	Mean yield per 1/120th acre in lbs.		
	Square A.	Square B.	Squares A & B combined.
M.E. 203 ...	17.9	19.2	18.6
Alor Star (local unselected) ...	20.0	17.6	18.8
N. 66 ...	19.3	18.1	18.7
Sm. 76 ...	19.6	20.9	20.3
Sm. 29 ...	22.9	21.6	22.3
Mean ...	19.9	19.5	19.7
S.D. ...	2.58 lbs.	2.66 lbs.	2.51 lbs.
S.D. as percentage of mean ...	12.9	13.6	12.7
M.S.D. ...	3.76 lbs.	3.90 lbs.	2.36 lbs.

Selinsing Test Plot.

Serious insect damage in the nurseries at this plot necessitated supplies of seedlings being brought from Briah Test Plot. Later in the season stem-borers became prevalent; nevertheless the season was generally satisfactory and yields exceeded those of previous years. The trials consisted of a five-way Latin Square duplicated, for comparison of certain medium maturation strains, and a four-way Latin Square for long-term Seraup strains. The results are summarized in Table XVI.

Table XVI.

Variety.	Mean yield per 1/120th acre in lbs.		
	Square A.	Square B.	Squares A & B combined.
Sm. 29 ...	17.1	15.5	16.3
Sm. 76 ...	13.1	13.1	13.1
N. 10 ...	15.6	15.9	15.8
N. 66 ...	13.4	13.4	13.4
M.E. 203 ...	10.8	10.1	10.5
Mean ...	14.0	13.6	13.8
S.D. ...	1.10 lbs.	1.50 lbs.	1.28 lbs.
S.D. as percentage of mean ...	7.1	11.1	9.3
M.S.D. ...	1.61 lbs.	2.20 lbs.	1.21 lbs.

Square C.	
Variety.	Mean yield per 1/120th acre in lbs.
S.K. 36 ...	13.5
S.K. 371 ...	16.3
S.K. 48 ...	15.3
S.K. 146 ...	16.4
Mean ...	15.4
S.D. ...	1.18 lbs.
S.D. as percentage of mean ...	7.7
M.S.D. ...	2.06 lbs.

Bukit Gantang Test Plot.

Conditions in this plot were rather unsatisfactory during the season. Trouble with the dam necessitated preparation of the land under difficult conditions. Rat damage occurred towards the end of the season and was so serious in one Latin Square as to render the figures obtained valueless. Damage by insects occurred to a minor extent. Harvesting was protracted by uneven ripening but weather at this time was dry and no lodging took place.

The trials consisted of five four-way Latin Squares, the results of which are shown in Table XVII.

Table XVII.

Square A.		Square B.	
Variety	Mean yield per 1/120th acre in lbs.	Variety	Mean yield per 1/120th acre in lbs.
S.B. 15 ...	23.3	S.B. 15 ...	23.0
S.K. 36 ...	23.6	S.K. 36 ...	20.1
S.K. 48 ...	20.0	S.K. 48 ...	20.6
S.K. 68 ...	20.0	S.K. 68 ...	19.8
Mean ...	21.7	Mean ...	20.9
No significance.		No significance.	

Square E.	
Variety	Mean yield per 1/120th acre in lbs.
R.S. 17 ...	12.1
R.S. 18 ...	10.3
R.S. 24 ...	9.6
R.S. 34 ...	7.8
Mean	10.0
S.D. 0.84 lbs. (8.4% of mean) M.S.D. 1.46 lbs.	
Note.—It is probable that these strains have interacted significantly with some factor severely limiting yields, and it is probably unwise to extend deductions beyond the actual site of the experiment.	

Note:—Square C. Rat damage was too extensive for any reliance to be placed on results.
Square D. Results were so uneven that they obviously have no value.

Talang Experiment Station.

Selection.—Twelve pure-line strains with medium or short maturation periods, transferred from Titi Serong Experiment Station, were maintained under the more suitable conditions at Talang.

Hybridization.—Successful crosses were made between Nachin 10 and Nachin 27 with the object of obtaining a strain combining the yielding capacity of Nachin 10 with the straw-strength of Nachin 27.

Varietal Trials.—The varietal trials consisted of a duplicated five-way Latin Square and three four-way Latin Squares (including one duplicate). On the whole the crop was satisfactory although dry weather at flowering caused some damage.

Table XVIII summarizes the results of these varietal trials.

Table XVIII.

Variety.	Mean yield per 1/120th acre in lbs.		
	Square A.	Square B.	Squares A & B combined.
Sm. 29 ...	22.8	20.3	21.6
Sm. 76 ...	22.4	21.1	21.8
M.E. 203 ...	26.8	22.9	24.9
R. 2 ...	22.2	21.6	21.9
N. 756 ...	23.2	23.2	22.3
Mean ...	23.5	21.5	22.5
S.D. ...	2.33 lbs.	2.82 lbs.	1.92 lbs.
S.D. as percentage of mean ...	9.9	13.2	8.8
M.S.D. ...	2.52 lbs.	3.05 lbs.	1.86 lbs.

Variety.	Mean yield per 1/120th acre in lbs.		
	Square C.	Square D.	Squares C & D combined.
R. 2 ...	22.9	16.3	19.6
R. 16 ...	22.6	16.9	19.7
R. 13 ...	25.5	21.6	23.6
R. 1 ...	25.0	22.5	23.7
Mean	24.0	19.3	21.7
S.D. ...	3.85 lbs.	2.57 lbs.	3.44 lbs.
S.D. as percentage of mean ...	16	13.3	15.8
M.S.D. ...	nil	4.64 lbs.	3.77 lbs.

Square E.	
Variety.	Mean yield per 1/120th acre in lbs.
R.S. 17 ...	20.7
R.S. 18 ...	16.6
R.S. 24 ...	21.5
R.S. 34 ...	25.0
Mean ...	21.0
S. D. 2.51 lbs. (11.9% of mean.) M. S. D. 4.36 lbs.	

Lenggong Test Plot.

Serious damage was caused to the crop at this plot by flood water. Extensive lodging and shedding of grain together with damage from rats made the results from three of the four Latin Squares valueless. Summarized results of the fourth square are shown in Table XIX.

Table XIX.

Variety.	Mean yield per 1/120th acre in lbs.
M.E. 203 ...	27.8
M. E. 210 ...	31.4
Sm. 29 ...	25.6
Sm. 76 ...	21.6
Mean	26.5
S. D. 4.22 lbs. (15.9% of mean) M. S. D. 7.34 lbs.	

Bruas Test Plot.

The season at this plot was fairly satisfactory. Unevenness of the land caused an unduly high experimental error in two of the three Latin Squares laid down. There was a shortage of water at flowering time owing to the collapse of a dam and dry weather. The summarized results of the varietal trials are shown in Table XX.

Table XX.

Square A.		Square B.		Square C.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
S.K. 36 ...	21.0	R. 4 ...	24.1	Sm. 29 ...	21.9
S.K. 48 ...	16.8	R. 13 ...	24.5	Sm. 76 ...	17.0
S.B. 15 ...	21.1	R. 7 ...	22.3	N. 66 ...	22.0
S.K. 371 ...	21.3	R. 2 ...	11.0	M.E. 203	18.3
Mean	20.1	Mean	20.5	Mean	19.8
S.D.	4.82 lbs.	S.D.	3.69 lbs.	S.D.	0.97 lb.
S.D. as percentage of mean	23.9	S.D. as percentage of mean	18.0	S.D. as percentage of mean	4.9
M.S.D.	8.36 lbs.	M.S.D.	6.43 lbs.	M.S.D.	1.89 lbs.

Sungei Tontong Test Plot.

As in previous years, a most unsatisfactory season was experienced and no useful results were obtained. Neither irrigation nor adequate drainage facilities exist; the soil is peaty and damage from pests is severe.

Selangor.

Panchang Bedena Test Plot

The crop on this plot suffered severely from insect and rat damage. The yield trials consisted of three four-way Latin Squares, the results of which are summarized in Table XXI.

Table XXI.

Square A.		Square B.	
Variety.	Mean yield per 1/120th acre in kati *	Variety.	Mean yield per 1/120th acre in kati *
S.B. 15 ...	11.2	R. 2 ...	7.6
R. 13 ...	8.0	R. 4 ...	4.7
S.K. 48 ...	8.0	R. 11 ...	4.2
S.K. 36 ...	10.7	R. 13 ...	7.4
Mean	9.47	Mean	5.99
S.D. 1.7 kati (19.9% of mean) No significance.		S.D. 1.79 kati (29.8% of mean) No significance.	

* 1 kati = $1\frac{1}{3}$ lbs.

Square C.	
Variety.	Mean yield per 1/120th acre in kati.
Sm. 29 ...	5.5
N. 66 ...	6.0
N. 756 ...	4.9
Sr. 824 ...	1.5
R. 13 ...	2.1
Mean	4.0

Note.—Eleven of the twenty-five plots in this square were completely destroyed by insects and rats. The results were therefore not worth analysis.

Sungei Haji Durani Test Plot.

The crop obtained at this plot was fairly satisfactory in spite of rather severe rat damage. The varietal trials consisted of four Latin Squares, the summarized results of which are shown in Table XXII.

Table XXII.

Square A.		Square B.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
S.B. 15 ...	3.83	R. 2 ...	8.0
R. 13 ...	6.75	R. 4 ...	11.6
S.K. 48 ...	5.25	R. 11 ...	10.75
S.K. 36 ...	8.46	R. 13 ...	7.9
Mean	6.08	Mean	9.56
S.D. 1.18 lbs. (19.4% of mean.) M. S. D. 2.05 lbs.		S.D. 1.98 lbs. (20.7% of mean) M. S. D. 3.46 lbs.	

Square C.		Square D.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
Sm. 29 ...	26.6	M.E. 203 ...	4.8
N. 66 ...	20.0	M.E. 88 ...	6.2
N. 756 ...	25.5	R. 13 ...	7.0
Sr. 824 ...	21.5	Rey. 20 ...	10.0
R. 13 ...	13.2		
Mean	21.3	Mean	7.0
S.D. 4.3 lbs. (20.2% of mean.) M. S. D. 6.3 lbs.		S.D. 3.3 lbs. (47% of mean.) M. S. D. 5.7 lbs.	

Tanjong Karang Test Plot.

Lack of water during the latter part of the growing season and severe rat-damage prevented reliable results being obtained from this plot.

Kuang Test Plot.

The crop here suffered so severely from rats, birds, insects and from unavoidable difficulties in water-control that no results of value were obtained.

Kajang Test Plot.

The varieties under trial were N 27, N 756, Acheh and Radin Siak. Of these the highest yielder was N 756 with the indifferent record of 292 gantangs per acre. Serious rat-damage together with water shortage resulted in a high experimental error and valueless results.

Negri Sembilan.

Kuala Klawang Test Plot *(Jelebu)*

Selection.—Selection of seventeen local varieties was undertaken. Two of these (Serendah Kuning and Serendah Puteh) were sent to Pulau Gadong (Malacca) for trial. The remaining fifteen were reserved for further selection.

Varietal Trials.—The unsuitability of the plot resulted in its abandonment at the end of the season in favour of a more suitable site. Three Latin Squares were laid down but planting took place too early for the short term varieties.

Excessively heavy bird damage occurred and no figures of value were obtained.

Kendong Test Plot.

Conditions in this plot were slightly less favourable than usual. Four Latin Squares were used in the varietal trials the results of which are summarized in Table XXIII. The highest yield was obtained from Milek Kuning 3 which gave a calculated crop of 1836 lbs. per acre.

Table XXIII.

Square A.		Square B.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
R.S. 18 ...	9.1	M.K. 3 ...	15.3
R.S. 17 ...	9.9	F.S. 11 ...	11.4
R.S. 7 ...	9.9	Serendah Kuning (local)	12.5
R.S. 24 ...	8.4	Sr. 875 ...	8.8
Mean	9.3	Mean	11.4
S.D. 0.9 lb. (9.7% of mean.) M.S.D. 1.6 lbs.		S.D. 1.26 lbs. (11.0% of mean.) M.S.D. 1.84 lbs.	

Square C.		Square D.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
R. 2 ...	10.5	S.K. 48 ...	11.6
N. 66 ...	13.6	R. 13 ...	10.6
Sm. 29 ...	14.5	S.K. 36 ...	10.6
Serendah Kuning (local)	14.0	S.B. 15 ...	13.2
Mean	13.2	Mean	11.5
S.D. 1.24 lbs. (9.4% of mean) M.S.D. 2.15 lbs.		S.D. 1.52 lbs. (13.2% of mean.) M.S.D. 2.62 lbs.	

Malacca.

Pulau Gadong Experiment Station.

Apart from certain portions of newly-opened land, a satisfactory season was experienced at this Station in spite of the somewhat adverse weather conditions.

Selection.—(a) Nachin. In order to confirm the results of the previous season in ear-to-row tests, a Latin Square of Nachin selections was planted. Results confirmed the belief that none of the more recent selections are superior to Nachin 66.

(b) Radin Siak. Work on this variety consisted of a Latin Square trial of four strains with the object of ascertaining the most satisfactory one for local conditions. Table XXIV shows the summarized result. No strain was significantly superior to the others.

Table XXIV.

Variety.	Mean yield per 1/120th acre in lbs.	Remarks.
R.S. 25 ...	21.8	S.D. 1.47 lbs. (6.4% of mean.) M.S.D. 2.60 lbs.
R.S. 17 ...	22.8	
R.S. 34 ...	23.2	
R.S. 24 ...	24.0	
Mean ...	22.9	

(c) Milek Puteh. Two Latin Square trials were laid down with the object of making final selections. Table XXV shows the results of this trial.

Table XXV.

Square A.		Square B.	
Variety.	Mean yield per 1/360th acre in kilos.	Variety.	Mean yield per 1/360th acre in kilos.
M.P. 7 ...	2.71	M.P. 7 ...	3.28
M.P. 8 ...	2.93	M.P. 18 ...	3.16
M.P. 9 ...	3.83	M.P. 12 ...	3.23
M.P. 148 ...	4.01	M.P. 14 ...	3.64
Mean ...	3.37	Mean ...	3.33
S.D. 0.258 kilos (7.6% of mean) M.S.D. 0.450 kilos.		No significance	

(d) Serendah. This was the first season of ear-to-row selections with this variety. One hundred and fifty rows were planted from one hundred and fifty single plant selections of the previous year. Twenty-nine selections were made for future observation.

(e) Varieties from Brunei. Four selected varieties were grown but results were unsatisfactory.

(f) Foreign varieties. Table XXVI shows imported varieties which were planted for trial during the season under review.

Table XXVI.

Variety.	Country of Origin.	Notes.
Oerang Oerangan	Java	Flowered 10 weeks after transplanting. Very poor in growth and yield.
Tong San	,,	Flowered 5 weeks after transplanting. Very poor in growth and yield.
Kar Serong	Java	Flowered 9 weeks after transplanting. Very poor in growth and yield.
Sze Min Lam Shum Tsim	Hongkong ,,	In ear 6 weeks after transplanting at height of 6 to 10 inches. Destroyed as they became a centre of insect attack.
Blue Stock Demerara Creole Ramacajara No. 75 No. 79	British Guiana ,, ,, ,, ,, ,, ,, ,, ,,	Growth poor. Flowered two months after transplanting, at height of 12 to 18 inches. Tillering was poor. A little grain was harvested.

Varietal Trials.—Two varietal trials were laid down in the form of Latin Squares, results of which are shown below in Table XXVII.

Table XXVII.

Square A.		Square B.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
N. 66 ...	23.4	R.S. 69 ...	16.9
M.P. 3 ...	27.1	R.S. 34 ...	17.1
M.P. 9 ...	24.9	N. 27 ...	16.6
Sm. 29 ...	23.6	M.P. 11 ...	16.1
Mean ...	24.8	Mean ...	16.67
S.D. 1.4 lbs. (5.6% of mean.) M.S.D. 2.44 lbs.		Not analysed. No significant differences.	

Pahang.

Temerloh Test Plot.

Weather conditions were generally favourable throughout the season, but there was a slight delay in transplanting due to deep water.

The summarized results of the varietal trials at this plot are shown in Table XXVIII.

Table XXVIII.

Square A.		Square B.	
Variety.	Mean yield per 1/150th acre in kati.	Variety.	Mean yield per 1/150th acre in kati.
R. 2 ...	6.12	N. 66 ...	13.88
Sri Ayer ...	7.42	Sm. 76 ...	13.31
M.K. 2 ...	3.22	M.P. 4 ...	13.78
M.K. 3 ...	3.68	Sm. 29 ...	17.62
Mean ...	6.35	Mean ...	14.65
S.D. 2.2 kati (34.6% of mean.) M.S.D. 3.79 kati.		S.D. 1.32 kati (9% of mean.) M.S.D. 2.3 kati.	

Square C.		
Variety.	Mean yield per 1/150th acre in kati.	Remarks.
Sr. 875 ...	6.87	S.D. 1.26 kati (20.6% of mean.) M.S.D. 3.26 kati.
R.S. 84 ...	7.48	
N. 27 ...	6.65	
R.S. 24 ...	3.37	–
Mean ...	6.1	

Dong Test Plot.

Growing conditions at this plot were satisfactory throughout the season, and good yields—giving a calculated mean for all strains of 2,586 pounds per acre—were obtained. The results of varietal trials which were carried out in five Latin Squares are summarized in Table XXIX.

Table XXIX.

Square A.		Square B.	
Variety.	Mean yield per 1/120th acre in kati.	Variety.	Mean yield per 1/120th acre in kati.
Sm. 29 ...	21.1	M.P. 11 ...	9.6
Sm. 76 ...	16.1	M.P. 7 ...	15.3
M.E. 210 ...	15.5	M.K. 2 ...	18.4
M.E. 203 ...	17.2	M.K. 3 ...	21.4
Mean ...	17.5	Mean ...	16.2
S.D. 2.4 kati (13.7% of mean.) M.S.D. 4.17 kati.		S.D. 1.82 kati (11.2% of mean.) M.S.D. 3.16 kati.	

Square C.		Square D.	
Variety.	Mean yield per 1/120th acre in kati.	Variety.	Mean yield per 1/120th acre in kati.
N. 66 ...	18.7	F.S. 12 ...	16.1
N. 11 ...	18.9	N. 27 ...	14.6
Rey. 20 ...	16.7	N. 756 ...	16.9
Gandar (local)	14.4	Sr. 875 ...	15.7
Mean ...	17.2	Mean ...	15.8
No significance		No significance	

Square E.		
Variety.	Mean yield per 1/120th acre in kati.	Remarks.
R.S. 17 ...	13.8	Manure having been applied to R.S. 24, the results were not analysed.
R.S. 18 ...	13.4	
R.S. 24 ...	16.4	
R.S. 34 ...	12.8	
Mean	14.1	

Kuala Lipis Test Plot.

This plot was utilized for the first time during the season. Being situated on an area of old well-worked land, and being favoured with good weather conditions the crop reaped was satisfactory.

The results of the six Latin Square varietal trials are shown in Table XXX.

Table XXX.

Square A.		Square B.	
Variety.	Mean yield per 1/120th acre in kati.	Variety.	Mean yield per 1/120th acre in kati.
S.K. 36 ...	11.1	Sm. 29 ...	14.3
T. Papan ...	7.9	Sm. 76 ...	9.1
R. 2 ...	10.1	M.E. 203 ...	10.9
R. 13 ...	14.9	M.E. 210 ...	12.9
Mean ...	11.0	Mean ...	11.8
S.D. 1.16 kati (10.5% of mean.) M.S.D. 2.02 kati.		S.D. 1.88 kati (15.9% of mean.) M.S.D. 2.75 kati.	

Square C.		Square D.	
Variety.	Mean yield per 1/120th acre in kati.	Variety.	Mean yield per 1/120th acre in kati.
M.K. 2 ...	17.1	N. 66 ...	11.4
M.K. 3 ...	21.0	N. 11 ...	8.5
M.P. 11 ...	9.0	Rey. 20 ...	16.0
M.P. 7 ...	12.9	Sri Menjadi (local)	12.4
Mean ...	15.0	Mean ...	12.2
S.D. 3.22 kati (21.4% of mean.) M.S.D. 5.6 kati.		S.D. 1.50 kati (12.3% of mean.) M.S.D. 2.6 kati.	

Square E.		Square F.	
Variety.	Mean yield per 1/120th acre in kati.	Variety.	Mean yield per 1/120th acre in kati.
Sr. 875 ...	10.0	R.S. 7 ...	13.9
N. 756 ...	12.9	R.S. 18 ...	13.0
F.S. 12 ...	13.3	R.S. 34 ...	11.9
N. 27 ...	10.6	R.S. 24 ...	14.4
Mean ...	11.7	Mean ...	13.3
S.D. 1.0 kati (8.5% of mean.) M.S.D. 1.74 kati.		Not analysed as manurial application was made to R.S. 24.	

Pekan Test Plot.

Weather conditions throughout the season were favourable. Varietal trials consisted of a comparison between eighteen pure strains and two local varieties tested in five four-way Latin Squares, the results of which are shown in Table XXXI. The mean calculated yield for all strains was 1,080 pounds per acre.

Table XXXI.

Square A.		Square B.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
N. 66 ...	12.9	M.K. 3 ...	12.5
R. 2 ...	7.5	M.K. 2 ...	13.0
R. 13 ...	8.5	M.P. 4 ...	9.1
Milek Puteh (local)	12.1	M.P. 7 ...	8.0
Mean ...	10.3	Mean	10.65
S.D. 1.58 lbs. (15.4% of mean.) M.S.D. 2.75 lbs.		Not analysed. Error should not be greater than in Square A.	

Square C.		Square D.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
M.E. 210 ...	7.8	Sri Ayer (local)	7.0
M.E. 203 ...	6.5	Sr. 875 ...	4.5
Sm. 29 ...	10.4	N. 27 ...	7.0
Sm. 76 ...	10.8	Sr. 824 ...	6.6
Mean ...	8.9	Mean ...	6.27
S.D. 0.66 lb. (7.4% of mean.) M.S.D. 1.15 lbs.		No significance (Z ratio 3.1 against 3.5 required)	

Square E.		
Variety.	Mean yield per 1/120th acre in lbs.	Remarks.
R.S. 24 ...	10.8	The variation between plots was too large for significance to be attained. Not analysed.
R.S. 18 ...	8.4	
R.S. 34 ...	7.9	
R.S.. 17 ...	8.8	
Mean ...	8.89	

Sungei Blat Test Plot.

Weather conditions during the season were not very favourable. Lack of water early in the season delayed preparation of the land and damaged the seedlings. The land is uneven and the growth of the crop was very irregular.

Varietal trials consisted of comparisons of nineteen pure strains and four local varieties in seven four-way Latin Squares. The results were too irregular to be of any value though the best yielders appeared to be Siam 29 and Nachin 66. The mean calculated yield per acre for all strains was 1,105 pounds.

Kelantan.

Central Experiment Station.

Varietal trials at this Station were laid out in five Latin Squares, the results of which are summarized in Table XXXII.

Table XXXII.

Square A. (Dry padi, long term)		Square B. (Wet padi, long term)	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
Jintan Manis ...	14.3	R. 13 ...	25.3
Jintan Koreng	14.7	Sm. 29 ...	32.2
Padang Serai ...	12.7	N. 66 ...	27.8
Anak Lebah ...	12.7	Sm. 76 ...	25.5
Kaki Merpati ...	13.8	N. 27 ...	24.8
Sa Bumi Puteh	15.8	R. 2 ...	24.7
Mean ...	14.0	Mean ...	26.9
No analysis was made as yields from three plots were very abnormal and there would obviously be no significant differences in yield.		S.D. 1.9 lbs. (7.0% of mean.) M.S.D. 2.5 lbs.	

Square C. (Wet padi, long term)		Square D. (Wet padi, short term)	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
S.B. 15 ...	26.7	Acheh ...	25.5
S.K. 36 ...	27.8	Jambu ...	20.8
S.K. 48 ...	24.3	R.S. 17 ...	24.0
R. 2 ...	26.7	R.S. 18 ...	23.0
R. 4 ...	24.5		
M.E. 203 ...	27.8		
Mean ...	26.3	Mean ...	23.8
S.D. 2.8 lbs. (10.6% of mean) M.S.D. 3.6 lbs.		S.D. 1.9 lbs. (8.1% of mean) M.S.D. 3.3 lbs.	

Square E. (Wet padi, short term.)		
Variety.	Mean yield per 1/120th acre in lbs.	Remarks.
Acheh ...	24.5	Figures from this plot were not analysed as they obviously show no significant differences.
Jambu ...	21.4	
R.S. 7 ...	22.8	
R.S. 24 ...	22.7	
Mean ...	26.3	

Pasir Puteh Test Plot.

Four varietal trials were laid down at this Station. The season was satisfactory and the trials gave results summarized in Table XXXIII.

Table XXXIII.

Square A.		Square B.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
Serendah ...	17.1	Chantek ...	16.6
Manik Siam ...	18.7	Anak Ulat ...	17.6
Nalong ...	18.6	Anak Ikan Tinggi ...	12.3
Padang Trengganu ...	19.1	Anak Naga ...	14.8
Siam ...	14.5	Sm. 29 ...	11.8
Mean ...	17.6	Mean ...	14.6
S.D. 1.47 lbs. (8.4% of mean) M.S.D. 2.15 lbs.		S.D. 1.97 lbs. (13.4% of mean) M.S.D. 2.87 lbs.	

Square C.		Square D.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
N. 756 ...	2.5	R. 4 ...	14.3
Sr. 824 ...	12.4	Sm. 76 ...	9.9
Sm. 29 ...	14.1	Sm. 29 ...	8.9
N. 66 ...	13.6	R. 13 ...	11.0
Mean ...	10.7	Mean ...	11.0
S.D. 1.43 lbs. (13.3% of mean) M.S.D. 2.48 lbs.		S.D. 1.17 lbs. (10.7% of mean) M.S.D. 2.04 lbs.	

Brunei.

Kilanas Test Plot.

The varietal trials at this plot consisted of five Latin Squares, two of which were rendered valueless by lack of crop from several of the plots. The results of the remaining three squares are shown in Table XXXIV.

Table XXXIV.

Square A.		Square B.	
Variety.	Mean yield per 1/120th acre in lbs.	Variety.	Mean yield per 1/120th acre in lbs.
S.K. 48 ...	16.2	R. 13 ...	10.6
S.K. 36 ...	16.5	R. 4 ...	11.66
S.B. 15 ...	17.7	R. 2 ...	12.6
Jongkok ...	18.7	Langsat ...	12.6
Mean ...	17.25	Mean ...	11.86
S.D. 1.15 lbs. (6.65% of mean) M.S.D. 2.0 lbs.		S.D. 1.28 lbs. (10.8% of mean) M.S.D. 2.2 lbs.	

Square C.		
Variety.	Mean yield per 1/120th acre in lbs.	Remarks.
M.E. 80 ...	19.3	S.D. 1.22 lbs. (6.3% of mean) M.S.D. 2.15 lbs.
Rey. 20 ...	21.2	
Rey. 6 ...	18.75	
M.E. 88 ...	18.75	
Mean ...	19.5	

Summary of the Present Position with regard to Yield Trials and Selection.

The main purpose of the yield trials and selection of padi at various stations throughout the country is to determine the particular variety or varieties most suited to the conditions peculiar to different localities. This is rendered necessary by the varying climatic and soil conditions and by differences in water control.

Yield trials of selected varieties of padi, (with modern lay-out and statistical analysis of results) have therefore been carried out for four or five seasons in all the more important padi-growing areas of the country, and the present position of our knowledge is briefly summarized below.

Krian.

In the northern section of this area where the land is soft and the water is generally rather deep, Seraup Kechil 48 has been found satisfactory. Three other strains of Seraup Kechil are still under trial and there appears to be little to choose between the four strains. About 700 acres of Seraup Kechil 48 have been planted on a Chinese estate, and a bonus offered by the local mill for this strain has resulted in the planting of a further 56 acres in one block by Malay small-holders.*

In the areas of Krian where intermediate conditions of land and water exist, the Radins have proved themselves the most useful. It is not yet certain which of the Radin strains will ultimately prove to be the best, and yield-trials are being continued in order to determine this point.

In the southern areas of Krian where the land is harder, and where water is comparatively shallow, the Malacca selection Siam 29 is generally satisfactory. Cultivators have been advised to plant this variety and seed has been distributed.

During the past season action has been taken to distribute seed of the best Seraup strains and of Siam 29 to local headmen and planters for demonstration purposes under normal field conditions. It is hoped that, in course of time, the largest possible area will be planted with pure strains of the two or three most suitable varieties in order that the local mills may obtain unmixed padi.

Kedah.

In Kedah the position has been reached where it is possible to recommend for general planting (according to local conditions) one of the following six varieties :—Chubai 18, Mayang Ebus 88, Radin Che Nah 28, Radin China 4, Radin China 17, and Reyong 20.

At the State Padi Show held in March, 1935, two local millers offered special prizes for samples of Reyong and Mayang Ebus and promised a bonus for large supplies of these strains.

Selection of other local and imported varieties is being continued in the hope of finding something even better than the present selections and of finding varieties suitable to particular local conditions.

Malacca.

In Malacca, milling is not yet of paramount importance, but the high yields and satisfactory eating qualities of Siam 29 and Nachin 66—and to a lesser extent of Nachin 11 and Siam 76—have caused an extensive demand for seed of these strains during the past three seasons. Although some 3,000 gantangs of seed have been distributed annually during the last five years the demand has consistently exceeded the avilable supply. There has also been a considerable demand for seed of these strains from the neighbouring State of Johore.

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* See "Milling Tests of Pure Strain Padi in Perak," *Malayan Agricultural Journal* Vol. XXIV No. 1, January, 1936.

One or two of the best selections of the short-term Radin Siaks have proved useful for distribution in areas where earlier plantings of long-term varieties have suffered damage from floods.

Province Wellesley.

In Province Wellesley distribution of selected strains has not been extensive as there is still some uncertainty as to the most suitable for local conditions. In the Central and Northern Districts Siam 29 and Mayang Ebus 203 are suitable for most areas except those in which the land is soft and the water deep. In such localities the Seraups which are proving their worth in North Krian, will probably be the most satisfactory.

Other Localities.

In Penang, Central and Southern Perak, Selangor, Negri Sembilan, the greater part of Pahang, in Kelantan, and Brunei, the best strains for general cultivation have not yet been determined. Certain strains under trial are promising, as may be seen by reference to the tables in the earlier part of this article.

Yield trials of such selections are therefore being continued in all these localities where it is not yet certain which strains are best suited to local conditions.

At all stations throughout the country work will be continued to determine the most satisfactory strains for particular local conditions. Selections from local and imported varieties will also be continued with the object of obtaining further improvement in yield and other desirable qualities.

PADI MANURIAL AND MINOR CULTURAL TRIALS.

Compiled by
R. G. H. WILSHAW,
Chemist, Rice Research.

During the season 1933-34 a complex cultivation and green manuring experiment was laid down to test the effect of the addition of green matter combined with manuring and different forms of surface cultivation. The layout of this experiment and the season's results are described in the *Malayan Agricultural Journal*, Vol. XXII, No. 12, 1934, where it is shown that cultivation but not manures had significant effects. It was thought possible that the residual effects of these manures might be evidenced in the second season. The trials at Telok Chengai, Bukit Merah, Titi Serong, Briah and Pulau Gadong were, therefore, repeated this season without further treatment. This experiment is subsequently referred to as the standard cultivation and green manuring experiment.

In the statistical tables S.D. stands for standard deviation, M.S.D. for minimum significant difference, and I.C. for the increase over control plot necessary to attain significance.

Telok Chengai Station.

Standard Cultivation and Green Manuring Experiment—Residual Effects.—No significant results were obtained.

Leaf Pruning.—A simple line experiment was laid down to determine the effect on yield of leaf pruning at transplanting, this being a common practice among padi planters in Kedah. Results showed no significant difference.

Disposal of Straw.—A four-way Latin Square was laid down to determine the effects of (*a*) removing the straw with the stubble, (*b*) burning the straw and the stubble, (*c*) spreading the straw over the surface of the soil, (*d*) burning the straw and adding rock phosphate 16/29 at the rate of 250 lbs. per acre. Only treatment (*d*) showed significant increased yield, but the experiment will be repeated next season and continued for some years.

Table I.

Disposal of Straw Experiment—Telok Chengai.

Mean Yields of Padi in lbs. per 1/60th acre.

Treatment.	Yield.	
(*a*) Padi straw removed ...	63.25	S.D. 2.28 lbs. (3.5% of mean)
(*b*) „ „ burnt ...	62.87	M.S.D. 3.97 lbs.
(*c*) „ „ left to rot ...	65.12	
(*d*) „ „ burnt + rock phosphate	70.5	

Bukit Merah Test Plot.

Standard Cultivation and Green Manuring Experiment—Residual Effects.— No significant results were obtained.

Titi Serong.

Standard Cultivation and Green Manuring Experiment—Residual Effects.— No significant results.

Disposal of Straw.—An experiment was started to determine the effect of (*a*) straw burnt during the dry season, (*b*) straw burnt at *menajak**, (*c*) straw spread at harvest, (*d*) straw removed. It was not expected that any significant effects would be evidenced during the first season. The experiment will be continued.

Briah.

Standard Cultivation and Green Manuring Experiment—Residual Effects.— No significant results.

Chelupping.—A four-way Latin Square was laid down to determine the effect of chelupping† with Perlis phosphate, the seedlings being stacked for two nights prior to transplanting. The small increase in yield obtained by chelupping was not significant and would have proved uneconomic.

Selinsing.

Cultivation and Manuring Experiment.—This experiment differs from the standard cultivation and manurial experiment in being designed to test tajaking against changkolling¶ combined with artificial manuring. It was started in 1932-33 and in the first season showed increases due to phosphates over control only. Last season however it showed significant differences for changkolling over tajaking as well as for phosphates over control. (*Malayan Agricultural Journal* Vol. XXII p. 597). This season the changkolled plots again show superiority over the tajaked.

Chelupping.—A four-way Latin Square was laid down similar to that at Briah. In this instance a significant effect was obtained of economic worth.

Table II.

Cultivation and Manuring Experiment at Selinsing Station.

Mean Yields of Padi in lbs. per 1/80th acre.

Treatment.	Control.	P.	N.P.	Mean.
Changkol ...	28.1	29.4	29.0	28.9
Tajak ...	25.8	26.5	25.4	25.9
Mean ...	26.9	27.9	27.2	—
M.S.D. between changkol and tajak 2.4 lbs.				

*Period when "tajaking" (scything weed growth with a local tool called a *tajak*) is being carried out.

† Chelupping = dipping padi seedlings.

¶ Cultivation with a mattock or digging hoe, locally termed *chankol*.

Table III.

Chelupping Experiment at Selinsing.

Mean Yields of Padi per 1/120th acre in lbs.

Treatment.	Yield.
Chelup ...	19.8
Control ...	17.9
M.S.D. is 1.2 lbs.	

Lenggong.

Planting Distance Experiment.—This experiment was continued from last season but the figures obtained for yields were too variable to give any significant results on analysis.

Talang.

Standard Cultivation and Green Manuring Experiment—Residual Effects.—No significant results.

Kendong.

Green Manuring Experiment.—A four-way Latin Square of 1/160th acre plots was laid down with the following treatments.

(*a*) 140 lbs. green manure six weeks before planting.
(*b*) 140 lbs. green manure two weeks before planting.
(*c*) 140 lbs. green manure one week before planting.
(*d*) Control—no manure.

No significant results were obtained. (Table IV.)

Table IV.

Green Manurial Experiment, Kendong.

Mean Yields in lbs. per 1/160th acre.

Treatment.	Yield.	
G.M. 6 weeks before planting	9.6	S.D. 1.52 lbs. (15% of mean)
G.M. 2 weeks „ „	9.6	M.S.D. 2.61 lbs.
G.M. 1 week „ „	10.8	
Control—no manure	10.5	

Pulau Gadong.

Standard Cultivation and Green Manuring Experiment—Residual Effects.—No significant results were obtained.

Pekan.

Planting Distance Experiment.—A four-way Latin Square of 1/120th acre plots was laid down to compare planting distances of 9 inches, 12 inches, 15 inches and 18 inches. Owing to damage from pig and the variation in yield recorded no reliable deductions could be drawn.

Manuring Experiment.—A manurial experiment laid down to test nitrogen and phosphorus mixtures was destroyed by pig and water.

Sungei Blat.

Cultivation Experiment.—A four-way Latin Square was laid down to test various depths of changkolling and puddling with buffaloes. The results obtained were too irregular to be of any value.

Central Station, Kelantan.

At the Central Station, Kelantan, two manurial experiments were laid down, one with artificials and one with organic manures. These gave results as indicated in Table V.

In addition to these manurial squares three small experiments were laid down in connexion with optimum spacing, rate of application of bat guano, and optimum P/N ratio. None of these experiments gave results justifying analysis.

Pasir Puteh.

Two manurial experiments were laid down at this Station. Green manure, bat guano and control plots, and an experiment on the optimum rate of application of bat guano. This latter gave no results justifying analysis, but the former showed significant results as summarized in Table VI.

Summary.

The manurial trials laid down during 1934-35 were few compared with those during 1933-34 or earlier seasons.

As in previous years it has proved impossible to surmount the "bar", *vide Malayan Agricultural Journal* Vol. XXII, p. 583, December, 1934, by application of economic dressings, although as before, statistical significant results have followed the application of manures including phosphorus as a component. These increases are in general too small to be of practical value. On one of the trials at the Central Station, Kelantan, however, and at Pasir Puteh, profitable results were obtained by the use of the local guano, green manure, and cow dung.

In regard to other experiments, the standard cultivation and green manuring clearly has no residual effect, whilst experiments in connection with the disposal of straw at Telok Chengai and Titi Serong are being followed up as they are unlikely to give any information until they have been in progress for some seasons.

Table V.

Manurial Experiments at Central Station, Kelantan.

Square I. Treatment.		Square I. Mean Yield per 1/40th acre in lbs.	Square II. Treatment.		Square II. Mean Yield per 1/40th acre in lbs.
1. Cyanamide Basic slag Sulphate of potash	1½ cwts. 2 cwts. 1 cwt.	59.8	Green manure Bat guano	5 tons 3 cwts.	70.8
2. Superphosphate	2 cwts.	60.5	Green manure Bat guano Sulphate of potash	5 tons 3 cwts. 1 cwt.	68.5
3. Superphosphate Sulphate of ammonia	2 cwts. 1½ cwts.	67.2	Bat guano Sulphate of potash	3 cwts. 1 cwt.	60.2
4. Superphosphate Sulphate of ammonia followed one month later by an additional	2 cwts. ½ cwt. 1 cwt.	72.0	Cow dung	5 tons	74.2
5. Basic slag Cyanamide	2 cwts. 1½ cwts.	64.2	*Baja bakar* *		66.8
6. Control—no manure		58.2	Control—no manure		59.0
Mean		63.9	Mean		66.6
S.D. 7.5 lbs. (117% of mean) M.S.D. = 9.7 lbs. I.C. = 8.6 lbs.			S.D. 5.9 lbs. (8.8% of mean) M.S.D. = 7.6 lbs. I.C. = 6.7 lbs.		

* A mixture of burnt soil, burnt cow dung and ashes of coconuts and areca leaves in general use in Kelantan under the name *baja bakar.*

Table VI.

Manurial Experiment at Pasir Puteh.

Treatment.	Mean Yield per lb. per 1/40th acre.	
Green manure (5 tons per acre) ...	43.0	S.D. 4.3 lbs. (10.5% of mean)
Bat guano (4 cwts. per acre) ...	48.2	M.S.D. = 5.5 lbs.
Control—no manure ...	31.8	I.C. = 4.9 lbs.

CONDITIONS ON RUBBER SMALL HOLDINGS IN MALAYA.

4th Quarter, 1935.

Prepared by the Economic Branch of the Department of Agriculture, Straits Settlements and Federated Malay States, in collaboration with the Field Branch of the Department.

Rainfall.

The quarter was a very wet one, heavy rains being experienced in all parts of the Peninsula, with consequent flooding in certain districts. The rainfall was lighter and more intermittent during December.

Prices.

Prices remained steady during the quarter, but shewed a slight improvement at the close. Tables I and II shew prices paid for small-holders' rubber at several centres in each State, the mean of the highest and lowest prices being given in Table II.

Production.

Production of rubber on small holdings during 1935 is summarized in Table III, and the previous year's figures are included for the purpose of comparison. This table is compiled from the monthly report of stocks, imports and exports of rubber published by the Registrar-General of Statistics, Straits Settlements and Federated Malay States.

Tapping.

The results of the quarterly survey of small holdings out of tapping are summarized in Table IV. Estimates are obtained by counting the number of such holdings, and applying the percentage to the total area of small holdings in the District.

It will be seen that the estimated acreage out of tapping increased very considerably during the last quarter of 1935. The comparative figures for the Federated Malay States are: September 145,200 acres (27.2 per cent.), December 203,900 acres (38 per cent.). For the Straits Settlements the relative figures are: September 24,000 acres (20.6 per cent.), December 33,100 acres (28.4 per cent.).

The increase in holdings out of tapping is even more noticeable when the above figures are compared with those obtained at the end of 1934 which were: Federated Malay States 41,000 acres, and Straits Settlements 11,600 acres.

The system of estimating the area out of tapping on small holdings has been extended to the States of Johore and Kedah. At the present time insufficient data is available of the total area of small holding rubber in each

Table I.

Lowest and Highest Rubber Prices Paid by Local Rubber Dealers.

(In Straits dollars per picul (133 1/3 lbs.))

4th Quarter 1935.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah
OCTOBER							
Smoked sheet	22.75-27.00	21.00-27.00	22.00-28.30	22.00-27.50	21.30-27.60	25.00-28.00	23.00-27.50
Unsmoked sheet	21.50-26.80	19.50-26.00	18.00-25.00	20.00-26.50	20.00-25.00	23.00-27.00	22.50-26.10
Scrap	15.00-18.00	—	18.00-20.00	17.00-21.00	—	17.00-21.50	17.00-25.00
NOVEMBER							
Smoked sheet	26.50-29.00	24.00-27.80	24.00-27.50	25.00-27.50	23.00-28.00	24.00-27.50	26.50-27.50
Unsmoked sheet	25.00-27.00	23.00-26.50	18.00-25.50	23.00-26.50	22.00-26.00	23.50-26.50	25.00-26.50
Scrap	16.50-21.50	19.00-20.00	20.00-22.00	8.00-23.00	—	17.00-22.00	20.00-21.25
DECEMBER							
Smoked sheet	26.25-28.50	24.50-27.75	23.00-27.50	24.00-27.50	24.00-27.50	25.00-28.50	27.00-28.00
Unsmoked sheet	25.00-27.60	21.00-26.55	20.00-26.00	20.00-26.50	23.00-26.00	23.75-27.00	25.00-27.00
Scrap	18.00-22.00	—	20.00-23.00	18.00-25.50	—	18.50-23.00	19.80-22.00

Table II.

Mean of Lowest and Highest Rubber Prices Paid by Local Dealers at a number of Centres in each State.

(In Straits dollars per picul (133 1/3 lbs.))

4th Quarter 1935.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah
OCTOBER							
Smoked sheet	24.06-25.62	23.52-25.63	24.33-26.97	23.08-26.50	22.23-26.24	25.33-27.33	25.33-26.17
Unsmoked sheet	22.50-24.70	21.28-24.53	21.50-23.25	21.33-25.00	21.48-24.32	23.67-25.33	24.48-25.87
Scrap	15.94-17.12	—	18.00-19.00	17.50-19.50	—	17.50-19.50	18.67-20.83
NOVEMBER							
Smoked sheet	26.75-28.00	25.55-26.86	25.28-26.80	25.60-27.20	24.17-26.73	25.17-27.08	27.00-27.16
Unsmoked sheet	25.50-26.75	23.92-25.22	22.25-23.95	24.42-25.75	23.75-25.15	23.83-25.67	25.33-26.00
Scrap	17.44-19.25	19.00-20.00	20.50-21.50	17.70-19.00	—	18.33-20.50	20.33-21.08
DECEMBER							
Smoked sheet	26.69-28.00	26.02-27.04	25.33-27.17	25.20-26.78	24.97-26.68	26.17-27.53	27.00-27.75
Unsmoked sheet	25.25-27.00	24.13-25.27	23.00-24.73	23.67-25.92	24.00-25.25	24.25-26.23	25.50-26.53
Scrap	19.06-20.94	—	21 50-23.00	21.40-22.60	—	20.00-21.50	20.43-20.93

Table III.

Production of Rubber on Small Holdings.
(in tons)

	Total Year 1934	1st Quarter 1935	2nd Quarter 1935	3rd Quarter 1935	4th Quarter 1935	Total Year 1935
Federated Malay States ...	104,141	16,736	17,374	19,255	14,015	67,380
Unfederated Malay States ...	81,495	16,021	13,593	13,260	11,987	54,861
Straits Settlements ...	31,403	2,867	3,432	3,911	3,018	13,258
Total ...	217,003	35 624	34,399	36,456	29,020	135,499

District to render this estimate of out-of-tapping as close as is possible for the Federated Malay States and the Straits Settlements. The area of small holdings out of tapping in Johore at the beginning of January 1936 was estimated to be 137,400 acres or 35 per cent., and in Kedah 38,300 acres (38 per cent.)

Ignoring Perlis, Kelantan and Trengganu, in which States the area of rubber small holdings is relatively small, the total area of rubber on small holdings out of tapping at the end of the year 1935 was about 412,700 acres, or 34 per cent.

There are several contributory causes for the large increase referred to above. In the first instance, December 1934 was exceptional for the almost complete drought then experienced, whereas in December 1935 the rainfall was extremely heavy, rendering tapping impossible over large areas. The usual end of the quarter shortage of coupons was noted in all reports, the shortage being more in evidence in view of the lower export quota as compared with the previous year. In many districts the completion of padi planting and the incidence of padi harvesting have resulted in rubber holdings being neglected. Undoubtedly, however, the principal reason for the reduction in tapping is the high price which can be obtained for coupons without rubber. All reports draw attention to the large trade carried on in coupons, the price for which rose to $21 per picul equivalent. The difference in price for rubber is not sufficient to meet production costs if labour is employed, and often owners themselves can find more profitable employment.

Condition of Holdings.

The relatively high prices prevailing, coupled with the pressure exercised by the officers administering the coupon issue, have resulted in the maintenance of a fairly high level of sanitation. The report from Selangor points out

Table IV.

Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less than 100 Acres, at the end of December, 1935.

PERAK

District	Total Tappable area	Total area untapped	Percentage
Batang Padang	37,288	8,900	24
Kinta	34,180	4,800	14
Kuala Kangsar	43,485	17,800	41
Upper Perak	13,774	2,900	21
Larut & Selama	51,407	4,100	8
Krian	9,751	6,700	69
Lower Perak*	47,937	19,700	41
Dindings	7,279	5,800	80
	245.101	70,700	29

SELANGOR

District	Total Tappable area	Total area untapped	Percentage
Klang	18,879	5,500	29
Kuala Langat	29,263	8,500	29
Ulu Langat	38,867	14,000	36
Ulu Selangor	30,632	6,400	21
Kuala Lumpur†	21,174	6,100	29
Kuala Selangor†	9,379	2,700	29
	148,194	43,200	29

NEGRI SEMBILAN

District	Total Tappable area	Total area untapped	Percentage
Seremban	19,241	16,700	87
Tampin	17,947	11,700	65
Kuala Pilah	17,470	5,400	31
Jelebu	6,270	3,300	52
Port Dickson	10,653	8,700	82
	71,581	45,800	64

PAHANG

District	Total Tappable area	Total area untapped	Percentage
Raub	7,361	1,000	13
Kuala Lipis	15,951	15,900	100
Bentong	13,600	2,900	21
Other Districts†	31,223	24,400	78
	68,135	44,200	65

MALACCA

District	Total Tappable area	Total area untapped	Percentage
Central	17,687	4,800	27
Alor Gajah	31,387	12,600	40
Jasin	24,971	5,200	21
	74,045	22,600	30

PENANG & P. WELLESLEY

District	Total Tappable area	Total area untapped	Percentage
North	3,241	400	12
Central	7,067	2,000	28
South	8,149	5,500	67
Penang	11,114	1,400	13
	29,571	9,300	31

SINGAPORE

District	Total Tappable area	Total area untapped	Percentage
Singapore	12,781	1,200	9
	12,781	1,200	9

The percentage of areas out of tapping in September, 1935, was as follows:—Perak 26, Selangor 29, Negri Sembilan 51, Pahang 12, Malacca 25, Penang and Province Wellesley 15. Singapore 10.

* Estimated from percentage for Kuala Kangsar.

†Estimated from percentage for other Districts in the State.

that these influences may lead to an undesirable degree of clean weeding on sloping land, while it is stated that in one district of the same State, small holdings are extremely dirty.

Diseases.

Mouldy Rot was prevalent throughout the quarter due to the very wet weather conditions. In Selangor its incidence was less severe than is usual for the quarter, and this fact is attributed to the marked decrease in tapping noted in the State.

Several cases of Pink Disease were reported from the Lipis District of Pahang, and in some areas considerable damage was done to young trees,

Grades of Rubber.

In some parts of the Peninsula there has been a tendency towards the selling of more unsmoked sheet, and in one report it was suggested that this was due to the desire of many small-holders to realize cash as quickly as possible in view of the Hari Raya festivities.

Another report states that it is noticeable that numerous small holdings are now producing unsmoked sheet where formerly smoked sheet was preferred, the reason given being that the difference in price offered by dealers is insufficient to cover the extra cost of production.

Kedah.—Smoked sheet continued to be the most popular form in which sales were made, but in South Kedah there was a slight increase in the production of unsmoked sheet. The percentages of smoked and unsmoked sheet respectively were :— North Kedah 89, 6; Central Kedah 58, 40; South Kedah 46, 31 (scrap 23).

Perak.—There still continues a preference for unsmoked sheet in most parts of Perak as is shewn by the following percentages: (smoked sheet is quoted first) :— Perak North 27, 73; Krian 41, 59; Selama 80, 20; Perak South 32, 68.

Selangor.—Preference is still shewn for smoked sheet, the percentage in the Klang District being 90, and 10 per cent. scrap. In the Kuala Lumpur District the percentages were smoked 43, unsmoked 57.

Penang and Province Wellesley.—As shewn in previous reports, there is a marked preference for unsmoked sheet. Average percentages for the quarter were: smoked 10, unsmoked 86, scrap 4.

Malacca.—Percentages were as follows: Central, smoked 80, unsmoked 10, scrap 10; Jasin, smoked 49.6, unsmoked 48.4, scrap 2; Alor Gajah, smoked nil, unsmoked 98.6, scrap 1.4.

Negri Sembilan.—The majority of small-holders' rubber was disposed of as unsmoked sheet. The average percentages of sales at twenty centres were: smoked 37, unsmoked 62, scrap 1.

General.

Considerable interest continues to be shewn by small-holders in the smoking cabinets demonstrated by the Asiatic Rubber Instructors, and in some cases where these cabinets have been installed an excellent quality of smoked sheet has been produced.

The Instructors have continued their demonstrations and lectures on the correct maintenance of small holdings, disease control, tapping systems, and preparation of good quality sheet, and reports indicate that, in consequence, the general standard of small holdings and of small-holders' rubber is steadily improving. In this connexion it is anticipated that the reduction in tapping at the end of the quarter will have a beneficial effect by providing a resting period which will aid bark renewal.

OIDIUM HEVEAE LEAF DISEASE, 1936*.

The Director will be obliged if proprietors or managers of estates will report early any suspected cases of *Oidium* Leaf Disease in 1936. In view of the fact that in 1935 a considerable amount of leaf-fall attributed to *Oidium Hevea* was in reality due to the microscopic insect Thrips, managers of estates where leaf disease is present are requested to send to the Institute a spray of foliage for diagnosis and confirmation.

Leaves picked from the ground are not suitable specimens for diagnosis. The specimen should consist of a spray of diseased young leaves and flowers picked direct from the tree and packed loosely and dry in strong paper. Posting at a time when the specimens are likely to lie in the post over a week-end should be avoided.

Oidium Heveae usually attacks only the newly-formed young leaves during refoliation after wintering and not the fully-mature leaves which fall during the wintering period.

A description of the disease has been published in the Institute's *Journal* (Vol. 2, No. 1, March 1930). Other articles on the disease and on treatment by sulphur dusting are published in subsequent numbers of the *Journal.*

Any manager who proposes to carry out sulphur dusting treatment either as a preventative or for the treatment of the disease is asked to notify the Director.

Attention is drawn to the fact that the disease is notifiable under the Agricultural Pests Ordinance (S.S.). and Agricultural Pests Enactment in each of the Federated Malay States, and in Johore and Kedah.

* The following Leaflet was published by the Director, Rubber Research Institute of Malaya in December 1935, and is reprinted in this Journal by request of the Director.

Abstract.

THE EXPORT CROPS OF THE NETHERLANDS INDIES IN 1934.

Bulletin No. 130 of the Central Bureau of Statistics of the Netherlands Indies.

This Report is especially interesting as a study of the effect of the universal trade depression on the economic situation in general, and in particular, of the reaction of the native population to these conditions.

As was to be expected, the production of foodstuffs for local consumption increased at the expense of the cultivation of export crops; the partial recovery of the export trade is evident, however, from the fact that the average value per metric ton of all agricultural products in 1934 was Gs. 104, as compared with Gs. 95 in 1933. The actual exports of such products amounted to 3,134,000 tons*, valued at 326 million guilders, as compared with 3,225,000 tons, valued at 306 million guilders in the previous year.

Of the total value of the 1934 exports of agricultural products, 64.7 per cent. was estate produce and 35.3 per cent. native grown.

Of the world exports of the important agricultural products, the percentage share of the Netherlands Indies in 1934 was : cinchona 90, pepper 80, kapok 79, rubber 37, coconuts 24, agave 23, tea 16, oil palm products 15.

Cane Sugar.

An area of 5,868 hectares† was planted with pedigree cane to serve as planting material. So great, however, was the decrease in the area planted that the crop from 4,181 hectares of this area had to be milled. In normal years, more than 11,000 hectares of nurseries are required. The total planted area was 34,211 hectares, as compared with 84,343 hectares in 1933 and 200,831 hectares in the peak year 1931. Native cultivation was not affected, the area planted remaining fairly stationary at 10,783 hectares.

The production of cane sugar was 636,104 tons, and exports were 1,089,248 tons.

Rubber.

The estate planted area is 601,286 hectares, of which 497,709 hectares are in bearing. Of the total, 144,618 hectares (or 24 per cent.) are budded rubber, fully half of which was planted in 1928 to 1930. The area of native holdings is unknown. Estate production was 192,830 tons, and total exports (including native rubber estimated on dry weight) were 385,492 tons, as compared with 286,818 tons in 1933.

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* Throughout this abstract, "ton" refers to the metric ton of 2,200 lbs.
† 1 hectare = 2.472 acres.

Of the estate area planted with rubber, 232,950 hectares are in Java, 348,940 hectares in Sumatra and 19,396 hectares in other islands.

The dry percentage of native rubber has greatly improved. The output of remilled native rubber in Netherlands Indies factories was 23,327,441 kilograms, as compared with 10,104,526 kilograms in 1933. Nearly 80 per cent. of the 1934 output came from Borneo.

Under the International Rubber Regulation Scheme the basic export quota for 1934 of the Netherlands Indies was 357,632 tons, of which 149,100 were allocated to native growers.

Coffee.

The planted area, as far as it is known, was 123,128 hectares on estates, and 22,986 hectares on native plantations in Java. This shews a slight increase over 1933. The production was 113,036 tons, of which 64,277 tons were from estates and 48,759 tons from native plantations in the Outer Provinces. The bulk of the production is Robusta coffee.

Tea.

The planted area on estates was 138,018 hectares (104,228 hectares in Java and 33,790 hectares in Sumatra), an increase of 174 hectares over 1933. The native area was 55,080 hectares, an increase over the previous year of 8,582 hectares. The area on estates in bearing was 131,396 hectares. The total quantity of made leaf on estates, including native leaf bought by estates and factories, was 71,293 tons, as compared with 75,292 tons in 1933, and 81,937 tons in 1932. The Netherlands Indies are included in the tea restriction scheme which came into force on 1st April 1933.

Tobacco.

The particular features of this trade in the Netherlands Indies have already been discussed in this Journal*. Cultivation of superior grades of leaf for cigar wrappers is limited to estate production on the East Coast of Sumatra. In 1934 this amounted to 12,862 tons, as compared with 13,069 tons in 1933, and 19,037 tons in 1930.

Estate cultivation of cheaper grades and European-managed curing of purchased native-grown leaf amounted to 18,916 tons in 1934. In addition, there is a large native output for local consumption as well as for export. It is estimated that the exports from this source in 1934 were 21,728 tons. There is also a small export trade in native cut-tobacco; exports of this grade in 1934 were 214 tons.

Cinchona.

The total area under this crop in 1934 was 18,336 hectares, 87 per cent. of which was in Java; total production amounted to 8,161 tons of dry bark. Restriction came into force on 1st March 1934.

* *Malayan Agricultural Journal,* Vol. XXII No. 2, February, 1934.

Oil Palms.

The growth of this industry in recent years may be seen in the following table relating to the Netherlands Indies.

Table I.

Oil Palms: Areas and Production.

Year	Estates	Planted area. Hectares				Production. Kgs.		Export. Kgs.	
		Java	Outer Prov.	Total	In bearing	Kernels	Oil	Kernels	Palm Oil and Kernel Oil
1930	48	707	60,522	61,229	30,017	9,820,548	49,751,695	9,639,066	48,014,596
1931	51	705	67,725	68,430	36,322	12,805,305	64,457,238	12,200,201	61,387,360
1932	50	710	69,365	70,075	43,833	18,413,577	90,072,649	17,884,341	84,973,111
1933	50	762	71,319	72,081	50,319	22,804,790	112,153,520	23,100,106	116,263,614
1934	50	736	73,093	73,829	55,740	24,878,483	130,646,781	25,068,446	121,261,680

Cultivation is still expanding, especially on the East Coast of Sumatra. Of the total area, 92.8 per cent. is in northern Sumatra, 6 per cent. in southern Sumatra, 1 per cent. in Java and 0.2 per cent. elsewhere. Of the total planted area, 75 per cent. is in bearing.

The Netherlands Indies contribution to world exports has, in the course of the period 1925 to 1934, risen—for kernels from 0.3 per cent. to 4.1 per cent., and for palm oil from 3.5 per cent. to 36 per cent.

Coconuts.

The estate area in bearing is: Java 5.644 hectares, Outer Provinces 34,597 hectares, total production from these sources in 1934 being 28,685 tons. Java never has more than a small surplus available for export after satisfying local demand, the bulk of the exports coming from the Outer Provinces. In 1934 Java actually had to import coconuts from the Outer Provinces for domestic consumption. Native production of copra in Java and Madura for consumption in the local mills is estimated to have been 176,600 tons in 1934. In addition, the net imports in terms of copra for the same purpose, from the Outer Provinces are estimated at 19,663 tons. These figures take no account of the production for culinary purposes, and that used by the small native oil mills.

The export surplus from the Outer Provinces, however, in 1934 was the equivalent of 453,383 tons of copra, only 23,765 tons of which were produced on estates.

The total exports of copra, oil and nuts, converted to copra equivalent* were 421,815 tons in 1934, as compared with 503,827 tons in the previous year.

Essential Oils.

The only cultivated essential oil crop of any importance was citronella grass. The total planted area was 26,913 hectares, of which 8,700 hectares were estates (mostly in Java). The exports of the oil shew a steady increase for the past few years; in 1934, 1,790,007 kilograms were exported, as compared with 1,528,870 kilograms in 1933 and 817,563 kilograms in 1930.

Exports of other essential oils in 1934 were (in kilograms): cajaput oil 64,871, ylang-ylang oil 15,687, vetiver oil 5,817, patchouli 3,041, lemon grass oil 125, palma rosa 55.

Hard-rope Fibres.

These crops, chiefly sisal, are still entirely estate production. The exports in 1934 were 69,672 tons as compared with 94,898 tons in 1933.

Kapok.

Only *Ceiba pendantra* L. Gaertn. is cultivated. It is chiefly a native-grown crop and the cleaning of the fibre from the pods is largely a village industry. The bulk of the exports of fibre and seeds, and the entire export of oil and oil cakes comes from Java. The 1934 exports were as follows:—

Fibre	Seeds	Oil	Oil Cake
21,030	26,088	2,757	10,490 metric tons.

Cocoa.

The area under cultivation is very slowly but steadily increasing. The 1934 exports were 2,093 tons, estate production being 1,600 tons. Practically the entire export of estate produce comes from Java. The quality of the product is stated to be good.

Pepper.

Cultivation is almost entirely in the hands of native and Chinese growers in Sumatra and Borneo. The 1934 exports were (in metric tons):—

	Black	White	Total
Sumatra and adjacent islands ...	25,878	16,332	42,210
Borneo ...	672	5,683	6,355
Total ...	26,550	22,015	48,565

* Basis of conversion: 4300 nuts = 1 metric ton of copra and 1000 litres of oil = 220 gallons = 1.5057 metric tons of copra.
100 kilos. of oil = 1.673 metric tons of copra.

The total exports in 1934 were 48,182 tons, as compared with 44,014 tons in 1933, 35,585 tons in 1932, and 31,756 tons in 1931.

Tapioca.

Tapioca is grown chiefly in Java as a native crop for local consumption, and a comparatively small part of the total production is exported. The native area planted in 1934 was 764,000 hectares, as compared with 701,000 hectares in 1933 and 650,000 hectares in 1930.

The exports of tapioca products in 1934 were (in metric tons): dried tubers 25,353, dried and ground 6,975, flour 92,972, flakes and siftings 5,990, pearl and seed 13,484, fibre residue 623. In 1934 about 75 per cent. of the exports of dried tubers went to Spain in consequence of a special reduction in the rate of freight to Barcelona.

Coca.

This is exclusively an estate crop and is exported as leaf. Production has steadily declined for some years past. In 1934 it amounted to 104,307 kilograms, as compared with 485,407 kilograms in 1929.

Gambier.

Gambier cultivation is almost entirely confined to Sumatra, Rhio and Western Borneo. Native production is about three times greater than estate production, but the bulk of the former is consumed within the Netherlands Indies, whereas about two-thirds of the foreign exports are estate produce. In 1934 the producing areas exported 5,954 tons to foreign countries, 6,160 tons to Java and 116 tons to the Outer Provinces.

Arecanut.

This is an entirely native crop. The total exports in 1934 were 42,840 tons.

Nutmegs.

No figures can be given for native-grown produce or for local consumption. The exports in 1934 were: shelled nuts (gross weight) 1,951 tons, unshelled nuts (gross weight) 2,078 tons, mace (net weight) 618 tons. The chief producing area is the Banda Islands group; further supplies come from the Moluccas, Celebes and mid-Java.

Cloves.

The greater part of the supplies are from Benkoelen in Sumatra, and the Moluccas. The export to foreign countries is small, as Java not only consumes the bulk of the production, but in 1934 imported 5,000 tons from foreign countries. The cultivation of this crop in Achin is rapidly increasing.

Rice.

The 1934 Java crop was 3,542,988 tons of husked rice, all of which was consumed in the country of production.

The net imports of rice into the Outer Provinces in 1934 were 243,577 tons.

Maize.

Maize is exclusively a native crop for domestic consumption. The 1934 production of Java and Madura was estimated at 1,719,700 tons, of which only 31,377 tons were exported. The Outer Provinces exported 11,526 tons to foreign countries; this is less than one-fifth of the 1933 exports..

Groundnuts.

The 1934 exports to foreign countries were 30,106 tons. Of this total, Java exported 27,839 tons, although the Java production was estimated at 149,400 tons.

Sago.

In the eastern parts of the Archipelago sago is consumed locally; the chief exporters are the East Coast of Sumatra and Rhio. The 1934 exports to foreign countries were 31,040 tons.

Potatoes.

Exports are decreasing; in 1934 they totalled 2,019 tons, as compared with 4,954 tons in 1932 and 6,321 tons in 1930.

Derris.

The exported derris is mainly a forest product from Sumatra. Cultivation has started, but no figures are available in respect of areas. Exports in 1934 were 136 tons as compared with 20 tons only in 1933.

Miscellaneous Crops.

Amongst a number of crops of minor importance may be mentioned chillies, the exports of which were 1,762 tons, onions, 1,736 tons, cotton 1,050 tons.

L. A. J. R.
D. H. G.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports submitted by Field Officers.

January, 1936.

The Weather.

The characteristic fairly cool, cloudy and generally wet weather attending the North-East Monsoon continued almost throughout the month, though towards its close there were signs that the usual shorter dry season was about to commence. In the northern half of the Peninsula the rainfall was well above average, but in the southern half it was little, if at all, above normal. On the west coast from Sitiawan southward precipitation was on the whole below the average, while on the east coast there was considerable variation in different localities. In Kelantan a heavy storm lasting two days accounted for 17½ inches out of a total of about 23 inches of rain. In Kuantan District, Pahang, the weather was comparatively dry, but from Pekan southward the rainfall was above average.

Remarks on Crops.

Padi.—In Kedah the padi harvest was in full progress, except around Baling. Weather conditions were less favourable than usual as showers and high winds caused extensive lodging and rendered difficult the work of threshing, drying and cleaning the grain. There was also a shortage of additional labour. Yields on the whole were good, but there was some loss of grain owing to lodging in the soft soil areas.

In Province Wellesley North reaping was continued but was somewhat retarded by deep water in the padi fields. Yields were expected to be good. Reaping was also in progress in Province Wellesley Central and in the South West District of Penang Island. Measured plots in the Central District gave yields of 300 to 360 gantangs per acre. Good yields were being obtained in the Island.

In Krian harvest was commenced in some localities, more especially Briah and Bagan Serai mukims. Rain delayed the drying of the fields after the water was drained away and also delayed ripening. Lodging has not been extensive, while up to the present additional labour for the harvest has caused no difficulty. Harvest was also in progress in the Kinta District of Perak and in the riverine areas of Lower Perak District where yields were on the whole good. Reaping of a moderate crop was completed in Batang Padang District. In most other parts of the State the crop was maturing and making good progress, but a further examination of the Sungei Manik areas showed that growth is uneven.

In the Panchang Bedena area of Selangor further transplanting brought the planted area to approximately 9,000 acres. Growth was good.

In Jelebu District of Negri Sembilan harvest was finished but yields were only fair. In Seremban, Rembau and part of Kuala Pilah District harvest was in progress.

In Malacca harvest was in full progress, except in the coastal area of Jasin District. Water in the fields hampered the work, but there was no difficulty in obtaining the necessary additional labour.

In Raub and Lipis Districts of Pahang harvest was in progress except in the riverine padi fields below Kuala Lipis where, as in Temerloh District, it was finished. In the Sungei Blat area of Kuantan District about 485 acres were planted and the condition of the crop was fairly satisfactory. During the month the Temerloh mill was able to purchase enough grain for about one week's work, but considerable further supplies were anticipated.

In Kelantan the dry padi crop was being harvested in Kota Bharu District. Both wet and dry padi were growing well and luckily suffered little damage from the severe storm which occurred in the middle of the month.

With the possible exception of Kelantan the crop for the present season is expected to be somewhat below that of 1935 in almost all of the important padi-growing areas. The price, however, has shown a little improvement.

Rubber.—Increases in the quantity of rubber sold by small-holders were reported from most parts of the country in January. This was due to the new issue of coupons and the need for money for the Chinese New Year holiday. Much of the increased output must, however, have been obtained in the second half of the previous month because on the whole there was a decrease in the number of small holdings tapped during January. The new issue of coupons, the improved price, and the impending holiday tended to increase tapping in the early part of the month, but this tendency was offset by the effect of wet weather, work on the padi harvest, the high price of coupons, which sold for around $23 per picul of export rights, and in the second half of the month by the Chinese New Year holiday itself.

Practically throughout the Peninsula rubber trees commenced to winter at the end of the month.

Several new small smoke cabinets were erected and some of these were brought into use and produced smoked sheet of fairly good quality, although there was often room for greater care in the preparation of the sheet before smoking.

Copra.—The steady and progressive improvement in the copra market has been responsible for an appreciable increase in the price of nuts and copra. There was, however, a relatively greater increase in the price of nuts, as the seasonal shortage continued in most areas, except Selangor, and the demand for domestic purposes was good.

In Johore the rise in price stimulated interest in copra production and in the manufacture of copra of better quality attended by renovation of kilns

in Batu Pahat District. An examination of numerous kilns in the Benut area showed that plank walls predominate, but that zinc or even asbestos sheets are frequently used. With slight improvements, costing but little, thoroughly dried copra could easily be produced. Discolouration of the copra is mainly due to the method of handling the nuts. In order to lessen bulk for transport in the drains, nuts are husked and split some miles from the kiln and, when the water in the drains is low, may not reach the kiln until two days after splitting. By that time slimes have formed on the meat which discolour the resulting copra and render impossible the preparation of a product of first quality. Producers are loath to alter their methods in order to overcome the defect of discolouration, but if splitting could be postponed it seems that the sacrifice of quantity would be more than repaid by improvement in quality.

Pineapples.—Supplies of fruit in Johore and Singapore decreased in quantity and deteriorated in quality during the month. Towards the end of the month factories in Johore were working for only two or three days each week. Prices for fresh fruits declined, being for 1st quality \$2.50 to \$3.10, for 2nd quality \$2 to \$2.80 and for 3rd quality \$1 to \$1.95 per hundred.

Fruits.—Good crops of the common tree fruits such as durians, mangosteens, rambutans, pulasans, langsats and mata kuching continued to be collected in Perak, Selangor and Pahang. In Negri Sembilan, however, the fruit crop was poor, providing only small quantities of durians and langsats. There was a large export of durians and rambutans from Larut District to Province Wellesley and Kedah. Exports of bananas and pineapples from Negri Sembilan to Selangor and of bananas from Batu Pahat District to Singapore were well maintained.

Tuba.—There has been a lively interest recently in the cultivation of this crop attended by considerable extension of the planted area in Perak South. In Malacca a number of local requests for planting material of *Derris elliptica* were being met from the ample supplies available at the Sungei Udang Agricultural Station. Considerable quantities of cuttings continued to be exported to Singapore at a price of \$6 per 1,000 from the Ayer Hitam area of Batu Pahat District in Johore. Growers in Negri Sembilan were importing supplies of cuttings from cultivators at Nyior in Kluang District. The sale of cuttings from these areas in Johore is sufficiently remunerative to cause stealing at night on a considerable scale. In such cases it is difficult to detect the culprits, but twenty arrests were made during the month. From Singapore over 470,000 cuttings were exported in five consignments.

Agricultural Stations and Padi Test Plots.

By the end of the month reaping was completed on the Telok Chengai Station and the Langgar and Rantau Panjang Plots in Kedah, Kajang and Kuang Plots in Selangor, Kuala Klawang Plot in Negri Sembilan and Temerloh Plot in Pahang. As stated elsewhere, harvest conditions were not ideal in several parts of the country, while heavy winds and rain caused somewhat extensive lodging on some of the plots.

On the Jitra Plot in Kedah yields were good, especially those of Mayang Ebus 80 and 88. At Kajang the varieties Kelantan and Acheh did well, each giving yields of over 500 gantangs per acre which is a high return for this area. On the Bawang Plot in Pekan District of Pahang Siam 29, Nachin 66, Reyong 20 and Radin Siak 24 did well. At the Jementah Plot in Johore floods, pest damage and wet weather at harvest caused extensive losses of crop, but in spite of this, yields of over 300 gantangs per acre were recorded as follows:—Nachin 66, 300; Radin 2, 344; Siam 29, 350 and Siam 76, 390 gantangs per acre, while of the local varieties Serendah Kuning gave 340 and Lembut Tembiling 451 gantangs per acre.

At the new Agricultural Stations, Ayer Itam in Penang, and Raub in Pahang, progress was made in planting permanent crops, tea and coffee at the former, and tea, pepper and citrus at the latter. Vegetable beds were laid out and the pineapple plot was planted at Bukit Kallam Station in Brunei.

In connexion with the propagation of fruit trees, it is reported that at Sungei Udang Station in Malacca 166 marcots were made of citrus, chiku, rambutan and pulasan, while some success attended the budding of durians. At the Pinneapple Station in Singapore jack fruit were budded on chempedak and Mediterranean sweet orange on sour orange stocks. Rambutans are propagated by etiolation, budding and in-arching. The latter method is reported to be more satisfactory than budding, as the high loss on potting budded stock is avoided. Budding of rambutans at Selama Station in Perak proved unsuccessful, although the buds remained green for several weeks.

At Kuantan Agricultural Station in Pahang improvement of the drainage system has been completed and has resulted in better growth of the crops. At the Cheras Station in Selangor the first crop of tea was plucked and prepared by the Chinese method.

Agricultural Instruction.

The second term at the Farm School at Malacca commenced on the 2nd January with 24 pupils. The school is now equipped with a shed for rubber manufacture by methods suitable for small holdings, a rubber smoke cabinet of the approved type and a model copra kiln. It was inspected by the Principal of the School of Agriculture, Malaya, on January 6th to 8th and received a satisfactory report.

As is usual at the approach of harvest, demonstrations were given to Malay headmen and padi growers on Padi Stations and Test Plots in various parts of the country.

Preliminary demonstrations of the use of the *tajak** and the Malacca plough in preparing padi land for planting were given in the riverine padi areas of the Lipis District below Kuala Lipis.

The Rural Lecture Caravan visited nine centres in the Ulu Langat and Kuala Langat Districts of Selangor during the period 14th January to 2nd February. Attendances were good.

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* An implement resembling a heavy short-bladed scythe, mounted on a straight wooden handle, used for cutting weeds in wet areas.

DEPARTMENTAL NOTES.

Visit of the Adviser on Agriculture.

At the request of the Government concerned, the Adviser on Agriculture visited Johore from 18th to 23rd January 1936. He conferred with the General Adviser, Johore, the Agricultural Officers, other officials and leading resident unofficials and visited all parts of the State.

Appointments.

Major C. D. V. Georgi, O.B.E., B.Sc., F.I.C., Assistant Chemist, Department of Agriculture, Straits Settlements and Federated Malay States has been appointed Chemist, Department of Agriculture, Straits Settlements and Federated Malay States, with effect from the 1st November 1935 inclusive.

Mr. W. J. Johnson, B.SC., A.C.G.I., has been appointed Canning Officer, Department of Agriculture, Straits Settlements and Federated Malay States, from 20th December, 1935. Mr. Johnson arrived in Malaya and assumed duty on 16th January, 1936.

Leave.

Mr. J. N. Milsum, Senior Assistant Agriculturist, returned from leave on 26th January, 1936.

Mr. R. B. Jagoe, Assistant Botanist, has been granted 8 months and 8 days leave from 11th January to 18th September 1936 inclusive.

Mr. B. Bunting, Agriculturist, has been granted 9 months and 2 days leave from 30th January to 31st October 1936.

Statistical.

MARKET PRICES.

January, 1936.

Rubber.—The market improved considerably during the month. Spot loose opened in Singapore at 22⅜ cents per lb. and rose to 24¼ cents on the 27th January, closing at 24 cents. The average price for the month for No. 1 X Rubber Smoked Sheet was 23.41 cents per lb. as compared with 21.74 cents in December. The average price in London was 6.76 pence per lb. and in New York 14.20 cents gold as compared with 6.33 pence and 13.05 cents gold in December.

Prices paid for small-holders' rubber at three centres during the month are shewn in the following table.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, January, 1936.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.					Kuala Kangsar, Perak.				Batu Pahat, Johore.
	2	9	16	23	30	8	15	22	29	15
Smoked sheet	27.13	28.06	30.00	29.46	30.01	28.65	29.07	29.98	29.85	
Unsmoked sheet	26.00	27.24	28.83	28.00	28.45		28.00			28.00
Scrap			25.00		26.00					

Transport by F. M. S. R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent

No purchases at Batu Pahat on the 1st, 8th, 22nd and 29th January, and at Kuala Kangsar on the 1st January.

Palm Oil.—Prices quoted during January for the Malayan commodities are given in the following table.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1936.	Palm Oil in Bulk, c.i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
Jan. 3	21. 0. 0	10. 17. 6
„ 10	20. 10. 0	10. 17. 6
„ 17	20. 10. 0	11. 10. 0
„ 24	20. 10. 0	11. 17. 6
„ 31	21. 15. 0	10. 16. 3

Copra.—This market was noticeable for a steady and considerable improvement in price maintained throughout the month. The sun-dried grade opened in Singapore at $5.90 per picul rising to $6.60 at the close. The average price for the month was $6.08, per picul as compared with $5.46 in December. The mixed quality shewed a similar improvement, averaging $5.51 per picul as compared with $4.89 in the previous month.

Copra cake remained unchanged at $1.40 per picul.

Rice.—The average wholesale prices of rice per picul in Singapore for December were as follows:—Siam No. 2 (ordinary) $3.62, Rangoon No. 1 $3.57, Saigon No. 1 $3.32, as compared with November corresponding prices of $3.89, $3.74 and $3.55. The corresponding prices in December 1934 were $2.95, $2.85 and $2.95.

The average retail market prices in cents per gantang of No. 2 Siam rice in December were:—Singapore 32, Penang 30, Malacca 27, as compared with 31, 31 and 27 respectively in November. The averages for the year were 30, 24, 27 respectively as compared with 23, 24, 24 for 1934.

The average declared trade value of imports of rice in December was $3.63 per picul, as compared with $3.66 in November and $3.80 in October. The average for the year was $3.65 as compared with $3.15 in 1934.

Padi.—The Bagan Serai Government Mill in Krian reduced the price for padi to $1.65 per picul, and a local mill was offering $1.55; Chinese buyers in that District were offering the equivalent of $1.95 to $2 per picul at the road side. The price at the Temerloh mill was $2 per picul. Chinese dealers bought part of the crop in the Central District of Malacca at $1.60 per picul.

Retail prices of padi varied between 6½ and 14 cents per gantang.

Tea.—During January thirteen consignments of Malayan tea were sold on the London market. Two consignments were of highland tea, and averaged 1s. 0¾d. per lb.; the remaining consignments were of lowland tea, and were sold at prices ranging from 11½d. to 1s. 0¼d. per lb., the average price being 1s.0.02d.

Average London prices per lb. during the month for tea consignments from other countries were as follows:— Ceylon 1s.1.91d., Java 11.04d., Indian Northern 1s.0.99d., Indian Southern 1s.0.8d., Sumatra 10.49d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report,* 27th January, 1936, of the Colombo Brokers' Association, and are as follows (rupee cents per lb.):— High Grown Teas 79 cents, Medium Grown Teas 68 cents, Low Green Teas 64 cents.

Tuba Root (Derris).—Prices fell in Singapore during January resulting in an increased demand. Roots sold on rotenone content averaged $45 per picul as compared with $48 in the previous month, and roots sold on a basis of ether extract fell to $28 per picul from $30 in December.

Coffee.—Sourabaya coffee improved slightly in Singapore in comparison with the previous month. The market opened and closed at $13 to $14 per picul, but fell in the middle of the month to $12.50 to $13.50. Palembang coffee weakened considerably, the average price for the month falling to $6.81 per picul as compared with $7.25 in December.

Locally grown coffee varied between $15 and $25 per picul according to quality.

Arecanuts.—The Singapore market improved slightly during January. Average prices per picul were:—Splits $4.75 to $6.85; Sliced $7.65 to $8.75; Red Whole $6.65 to $7.75.

The Singapore Chamber of Commerce average prices per picul were:—Best $6.52, Medium $6.07, Mixed $4.99.

Gambier.—Prices per picul in Singapore remained unchanged throughout the month at $6.50 for Block and $10 for No. 1 Cube. The December average prices were $6.75 and $10 respectively.

Pineapples.—The market is steady with not much business passing. Prices were reduced during the month, the average prices per case being Cubes $3.50, Sliced Flat $3.30, Sliced Tall $3.44, as compared with $3.55, $3.35 and $3.50 respectively in December.

Prices for fresh fruits declined being: 1st quality $2.50 to $3.10, 2nd quality $2 to $2.80, 3rd quality $1 to $1.95 per 100.

Tapioca.—Prices per picul remained unchanged throughout January in Singapore at the following levels: Flake Fair $5.50, Seed Pearl $5.50, Medium Pearl $6.50. The December average prices were $5.69, $5.69 and $6.50 respectively.

Sago.—Pearl, Small Fair, continued unchanged at $3.75 per picul, but Flour, Sarawak Fair, fell still further, averaging $2.50 per picul as compared with $2.59 in December.

Mace.—Siouw improved to $105 per picul, remaining unchanged at this price throughout the month, as compared with $100 in December. Amboina also improved, the price rising to $75 per picul, with an average for the month of $74.50 as compared with $70 in December.

Nutmegs.—Singapore prices fell in the second half of January, but average prices shewed an improvement over the previous month. January averages per picul were: 110's $35.50, 80's $36, as compared with $34.50 and $35.50 in the previous month.

Pepper.—Prices in Singapore were marked up slightly, but little business was reported. Average prices per picul for the month were: Singapore Black $9.06, Singapore White $16.88, Muntok White $17.38, as compared with $9, $16.50 and $17 respectively in December.

Cloves.—Nominal Singapore prices remained unchanged at $37 per picul for both Zanzibar and Amboina.

Cardamoms.—According to the Ceylon Chamber of Commerce weekly reports green cardamoms were quoted during January at 95 rupee cents to R. 1.06 per lb. rising to close at R. 1 to R. 1.17.

Tobacco.—Prices for cured leaf per picul were as follows:— 1st quality $25 to $60, 2nd quality $12 to $40, 3rd quality $10 to $25. In Port Dickson, Negri Sembilan, very high prices were again recorded, the range being $75 to $90, $35 to $80, $15 to $75. In Kelantan also, prices were high, 2nd quality being $80, and 3rd quality $40 per picul.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross. London, S.W.1.

GENERAL RICE SUMMARY.*

December, 1935.

Malaya.—Imports of foreign rice during December were 40,674 tons, and exports 16,037 tons, net imports being 24,637 tons. The total net imports for the year were 470,384 tons as compared with 453,229 tons in 1934.†

Of the imports during December, 54 per cent. were consigned to Singapore, 13 per cent. to Penang, 7 per cent. to Malacca, 21 per cent. to the Federated Malay States, and 5 per cent. to the Unfederated Malay States. Of the total, 72 per cent. came from Siam, 23 per cent. from Burma, 4 per cent. from French Indo-China, and 1 per cent. from other countries.

Of the exports during December, 72 per cent. were consigned to the Netherlands Indies, and 28 per cent. to other countries. The various kinds of rice exported were: Siam 13,191 tons (82.3 per cent.), Burma 2,006 tons (12.5 per cent.), French Indo-China 757 tons (4.7 per cent.), parboiled rice 44 tons (0.3 per cent.), local production 39 tons (0.2 per cent.)

India and Burma.—Foreign exports for the eleven months January to November, 1935, totalled 1,591,000 tons, as compared with 1,327,000 tons in 1934, an increase of 19.9 per cent. Of the 1935 exports 3.8 per cent. were to the United Kingdom, 9.6 per cent. to the Continent of Europe, 25.5 per cent. to Ceylon, 31.3 per cent. to the Straits Settlements and Far East, and 29.8 per cent. to other countries. The corresponding 1934 percentages were: 8.4, 17.9, 25.6, 20.0, and 28.1.

Burma's total exports of rice and bran (*Bangkok Times*, 21st November, 1935) from January to November 1935 aggregated 3,262,823 metric tons, as compared with 3,630,041 metric tons in 1934, a decrease of 10.1 per cent.

According to the third forecast of the rice crop in Burma for the season 1935-36, the area likely to mature is estimated to be 12,226,100 acres, or 123,800 acres less than the previous season's final figure. The decrease is, however, likely to be considerably overbalanced by the better condition of the crop.

The exportable surplus of the 1935-36 harvest is estimated at 3,600,000 tons of rice and rice products.

Siam.—Exports of rice and rice products from Bangkok during November were 139,184 tons (provisional). The cumulative total for the year is 1,408,072 tons as compared with 1,716,236 tons in 1934.

Japan.—No further information is available since the November Summary.

French Indo-China.—Entries of padi into Cholon during 1935 totalled 1,584,232 metric tons, as compared with 1,581,481 metric tons in 1934, an increase of 0.2 per cent. Exports of rice for the same period were 1,718,013 metric tons, an increase of 9.0 per cent.

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* Abridged from the Rice Summary for December, 1935, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1934.

Netherlands Indies.—No further information is available since the November Summary.

Ceylon.—Imports for the year 1935 totalled 533,253 tons as compared with 477,631 tons in 1934, an increase of 11.6 per cent.

Of these imports 12.9 per cent. were from British India, 65.2 per cent. from Burma, 0.7 per cent. from the Straits Settlements, and 21.2 per cent. from other countries. The corresponding percentages for 1934 were 14.2, 61.5, 1.8 and 22.5.

Europe and America.—For the period 1st January to 19th December 1935 shipments from the East to Europe aggregated 750,718 tons, as compared with 1,172,063 tons in 1934, a decrease of 35.9 per cent. Of the 1935 shipments 43.4 per cent. were from Burma, 3.2 per cent. from Japan, 46.1 per cent. from Saigon, 5.9 per cent. from Siam, and 1.4 per cent. from Bengal. The 1934 corresponding percentages were 33.4, 4.0, 51.1, 9.7 and 1.8.

Shipments for the Levant from 1st January to 25th November, 1935, were 28,895 tons, an increase of 2.2 per cent. as compared with 1934.

Shipments for Cuba, West Indies and America from 1st January to 6th December, 1935, totalled 248,202 tons, an increase of 36.6 per cent. as compared with 1934.

MALAYAN AGRICULTURAL EXPORTS, DECEMBER, 1935.

PRODUCT.	Net Exports in Tons.			
	Year 1934.	Year 1935	December 1934	December 1935
Arecanuts ...	27,336	21,885	1,560	2,248
Coconuts, fresh † ...	100,804†	100,428†	11,039†	2,808†
Coconut oil ...	25,485	35,911	2,347	3,905
Copra ...	95,599	111,752	8,925	16,297
Gambier, all kinds ...	2,170	2,837	144	180
Oil cakes ...	11,273	11,361	676	1,506
Palm kernels ...	3,196	3,892	425	355
Palm oil ...	15,852	24,996	797	2,047
Pineapples canned ...	66,634	73,923	4,840	8,866
Rubber ¶ ...	479,371¶	378,497¶	52,500¶	25,322¶
Sago,—flour ...	10,403	10,920	1,944	2,430
„ —pearl ...	5,058	4,655	1,683	388
„ —raw ...	7,079*	7,735*	753*	820*
Tapioca,—flake ...	5,761	1,953	169	153
„ —flour ...	1,842*	755*	56*	150*
„ —pearl ...	15,770	17,169	1,425	1,479
Tuba root ...	481	567	20	48

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION (IN TONS) OF PALM OIL AND KERNELS

(As declared by Estates)

Month 1935	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S.
January, ...	1,062.3	339.3	174.0	49.6
February ...	977.4	220.9	161.7	38.5
March ...	1,104.3	334.2	172.6	48.6
April ...	1,008.2	328.0	151.2	40.4
May ...	1,077.1	461.8	158.6	63.1
June ...	1,311.0	724.1	200.9	105.5
July ...	1,901.2	729.0	255.3	109.0
August ...	2,331.5	777.9	345.5	120.0
September ...	2,080.0	607.4	231.3	87.7
October ...	1,869.8	512.8	306.5	54.4
November ...	1,464.3	400.5	280.1	58.4
December ...	1,151.6	328.7	273.4	43.2
Total 1935 ...	17,338.7	5,764.6	2,711.1	818.4
Total for year 1934 ...	12,965.0	4,510.0	2,013.0	795.0

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 31ST DECEMBER, 1935.

State or Territory	Acreage of Tappable Rubber end 1934	Estates which have entirely ceased tapping		Estates which have partly ceased tapping (a)		Area of Tappable Rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,691	484	1.1	14,121	31.6	592	1.3	14,605	32.7
Malacca	123,793	1,730	1.4	29,340	23.7	3,354	2.7	31,070	25.1
Penang Island	2,593	9	.4	460	17.7	124	4.8	469	18.1
Singapore Island	33,312	3,014	9.0	7,445	22.4	614	1.8	10,459	31.4
Total S.S. ...	204,389	5,237	2.6	51,366	25.1	4,684	2.3	56,603	27.7
FEDERATED MALAY STATES :—									
Perak	295,895	10,400	3.5	60,288	20.4	11,401	3.8	70,688	23.9
Selangor	345,100	11,093	3.2	66,842	19.4	12,274	3.6	77,935	22.6
Negri Sembilan	258,381	12,420	4.8	48,608	18.8	13,364	5.2	61,028	23.6
Pahang	75,912	9,262	12.2	23,665	31.2	12,546	16.5	32,927	43.4
Total F.M.S. ...	975,288	43,175	4.4	199,403	20.5	49,585	5.1	242,578	24.9
UNFEDERATED MALAY STATES :—									
Johore	417,633	21,090	5.0	70,018	16.8	35,587	8.5	91,108	21.8
Kedah	199,180	3,880	1.9	22,423	11.3	19,349	9.7	26,303	13.2
Kelantan	28,891	403	1.4	8,964	31.0	4,560	15.8	9,367	32.4
Trengganu (b)	4,643	Nil	Nil	15	0.3	5	0.1	15	0.3
Perlis (c)	1,206	Nil	Nil	719	59.6	64	5.3	719	59.6
Brunei	(d) 4,991	Nil	Nil	1,607	32.2	841	16.8	1,607	32.2
Total U.M.S. ...	656,544	25,373	3.9	103,746	15.8	60,406	9.2	129,119	19.7
TOTAL MALAYA ...	1,836,221	73,785	4.0	354,515	19.3	114,675	6.2	428,300	23.3

Notes :—(a) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(b) Registered Companies only.
(c) Rendered quarterly.
(d) Acreage of tappable rubber on 1st May, 1934.

MALAYA RUBBER STATISTICS TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF DECEMBER, 1935, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		Jan. to Dec. inclusive 1935		during the month		Jan. to Dec. inclusive 1935						
	Ports	Dealers	Estates of 100 acres and over	during the month	January to Dec. inclusive 1935	during the month	January to Dec. inclusive 1935	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to Dec. inclusive 1935
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES:—																				
Federated Malay States ...	...	7,953	10,864	10,893	133,067	2,736	67,380	Nil	Nil	17	Nil	9,983	3,930	*161,972 †150,022	47,139	...	5,337	13,187	9	108
Johore ...	...	1,657	3,823	3,841	48,967	1,159	35,850	Nil	13	Nil	181	1,827	2,812	29,772	53,587	...	1,632	4,222	...	...
Kedah ...	...	299	2,579	2,642	30,637	542	10,990	Nil	Nil	Nil	Nil	1,217	1,280	17,709	22,121	...	181	3,384	...	...
Perlis ...	...	17	11	13	131	6	214	Nil	Nil	Nil	Nil	Nil	23	Nil	360	...	7	17	...	...
Kelantan ...	...	393	274	238	3,882	183	5,558	Nil	Nil	Nil	Nil	71	466	1,980	7,243	...	212	339	...	...
Trengganu ...	...	55	50	101	3,021	51	1,512	Nil	Nil	Nil	Nil	Nil	152	Nil	4,533	...	55	50	...	...
Brunei	...	11	43	59	628	73	737	...	...	...	...	...	133	...	1,338	...	3	50	...	...
Total Malay States	...	10,385	17,644	17,787	220,333	4,750	122,241	Nil	13	17	181	13,098	8,796	211,433	136,321	...	7,427	21,249	9	108
S. SETTLEMENTS :-																				
Malacca ...	...	2,378	1,145	1,078	14,618	342	7,407	Nil		Nil		2,172		31,029		...	1,308	1,406	...	...
Province Wellesley	...	1,989	449	467	5,640	168	2,817	Nil		Nil		7,976		89,278		...	1,691	610	...	...
Penang ...	3,173	6,069	13	17	195	150	1,297	2,875	8,714	26,762	135,120		Nil		Nil	2,250	5,925	9	...	...
Singapore ...	2,911	20,444	169	147	2,096	278	1,555	4,579		146,843		14,592		258,579		3,669	16,460	160	58	485
Labuan	...	25	Nil	Nil	Nil	22	182	75		1,030		Nil		Nil		...	39	Nil	...	...
Total Straits Settlements	6,084	30,905	1,776	1,709	22,549	960	13,258	7,529	8,714	174,635	135,120	24,740	Nil	378,886	Nil	5,919	25,423	2,185	58	485
TOTAL MALAYA	6,084	41,290	19,420	19,496	242,882	5,710	135,499	7,529	8,727	174,652	135,301	37,838	8,796	590,319	136,321	5,919	32,850	23,434	67	593

*Ocean shipments from Malaya of rubber directly consigned from the F.M.S.   † Exports of rubber from the F.M.S.

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	4,733	16,067	5,406	2,912	1,460	139
WET RUBBER	604	393	519	129	172	42
TOTAL ...	5,337	16,460	5,925	3,041	1,632	181

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to Dec. 1935
29	30	31
Singapore ...	22,585	386,304
Penang ...	11,002	136,041
Port Swettenham.	3,953	63,815
Malacca ...	298	4,159
MALAYA ...	37,838	590,319

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to Dec. 1935
32	33	34
Malay States ...	21,894	335,503
Straits Settlements	2,611	35,079
MALAYA ...	24,505	370,582

Notes:—
1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23 January, 1936.

METEOROLOGICAL SUMMARY, MALAYA, DECEMBER, 1935.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of		Mean of A and B.	Absolute Extremes				At 1 foot	At 4 feet	Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.		Highest Max.	Lowest Min.	Lowest Max.	Highest Min.					Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	89.6	71.6	80.6	93	70	85	74	83.7	84.3	10.32	262.1	1.95	21	18	3	9		167.75	5.41	45
Bukit Jeram, Selangor ...	87.1	71.9	79.5	90	70	84	74	82.2	84.5	12.19	309.6	3.20	23	18	4	3		191.10	6.16	52
Sitiawan, Perak ...	87.4	72.8	80.1	90	71	84	75	82.7	83.5	7.15	181.6	1.20	22	19				210.05	6.77	57
Temerloh, Pahang ...	85.9	71.9	78.9	91	70	76	73	83.2	84.9	10.26	260.6	1.92	25	22	2	5	1	149.85	4.83	41
Kuala Lipis, Pahang ...	86.0	71.0	78.5	91	68	76	73	82.1	83.4	12.03	305.6	3.01	24	18	3	19		154.05	4.97	42
Kuala Pahang, Pahang ...	83.9	73.5	78.7	86	72	79	76	81.8	84.1	25.31	642.9	4.78	24	19			1	176.50	5.69	48
Kallang Aerodrome, S'pore ...	84.8	74.5	79.7	89	72	77	76	81.0	82.1	9.39	238.5	1.53	19	17	5			153.60	4.95	41
Butterworth, Province Wellesley ...	86.7	72.6	79.7	90	70	79	76	84.0	84.8	6.45	163.8	1.63	14	13				220.05	7.10	60
Bayan Lepas Aerodrome, Penang ...	86.8	73.6	80.2	90	72	79	77	82.8	83.4	6.05	153.7	0.78	19	17	2			218.60	7.05	60
Bukit China, Malacca ...	84.5	73.0	78.7	89	71	77	75	82.0	83.1	7.94	201.7	1.80	20	17	1		2	191.35	6.17	51
Kluang, Johore ...	85.9	70.8	78.3	91	67	73	73	80.8	81.9	9.53	242.1	1.68	20	18	2	15		136.45	4.40	37
Bukit Lalang, Mersing, Johore	82.6	71.7	77.1	88	70	75	73	79.8	80.9	30.48	774.2	5.66	25	23	1	1		164.40	5.30	44
Alor Star, Kedah ...	87.8	72.3	80.1	91	69	79	75	83.7	85.2	5.19	131.8	2.08	17	13	6	1		196.45	6.34	53
Kota Bahru, Kelantan ...	83.8	72.9	78.3	88	70	76	74	81.2	83.3	22.94	582.7	3.30	22	21			1	142.25	4.59	39
Kuala Trengganu, Trengganu	84.1	72.9	78.5	88	70	76	77	80.2	81.7	22.51	571.8	3.16	24	22			3	157.75	5.09	43
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	70.9	61.6	66.3	76	60	63	63	71.1	71.8	15.44	392.2	1.66	29	27		24		118.75	3.83	32
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	71.7	56.9	64.3	76	49	64	61	68.7	69.1	10.66	270.8	1.40	22	20			4	117.45	3.79	32
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	70.7	58.5	64.6	76	56	63	60			10.80	274.3	1.70	23	20			4	128.65	4.15	35

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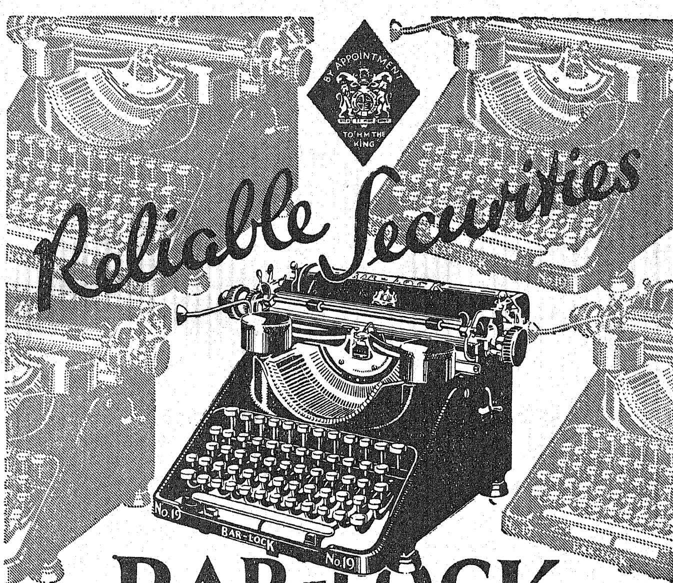
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THE

Malayan Agricultural Journal.

MARCH, 1936.

EDITORIAL.

The agricultural research officer cannot afford to consider the particular problem on which he is working as an isolated investigation unrelated to similar problems engaging the attention of scientists in other countries. Although the local conditions may be peculiar—this is indeed the reason that research on the same subject must be duplicated in different countries—there remain generalities which are common to all. Furthermore, most investigations in a Department of Agriculture cannot be confined to "pure research"; they must be approached, or more frequently, they must converge, to a consideration of the practical application of results.

In these days of rapid advance in agricultural science it is therefore of first importance that due consideration be given to the methods of agriculture employed in other countries, with the object of comparison and the hope that where applicable, valuable common practices in one country may become innovations in another country.

In technical research, the investigator is able to keep in touch with work of a similar nature in other countries, mainly by means of exchange publications. For instance, in exchange for the regular supply of all issues of *The Malayan Agricultural Journal,* the Malayan Department of Agriculture receives agricultural publications from 215 sources.

Similar information on the practice of agriculture in various countries is less up-to-date and less general than that of a scientific nature. The Department of Agriculture has advanced a considerable way towards comparing the systems of agriculture of the more important crops grown in this country with the methods obtaining in other countries, and much of this information has been published from time to time.

In the present number, our two main articles concern the copra industry in the Solomon Islands, and the rice industry in Burma. The former article is compiled by Mr. H. T. Pagden who, after four years of research work in Malaya, spent two years in the Solomon Islands. In connexion with problems concerning the coconut industry we would also draw attention to a new publication of the Department reviewed in this number, in which Mr. F. C. Cooke, Officer-in-Charge of Copra Investigations, reports on a visit to the Philippines for the purpose of studying the conditions of the coconut industry in that country. It

will be remembered that previously Mr. Cooke reported on the coconut industry in Ceylon*. We have, therefore, comprehensive accounts of this industry in three important countries of production to compare with the methods obtaining in Malaya.

Our second article in this number is by Mr. Parker, Manager of the Government Rice Mill at Bagan Serai, Perak. Mr. Parker is a practical miller, and in his visit to Burma he was chiefly concerned with the practical aspects of the sale and transport of padi to the mill, the milling quality of the padi and the commercial aspect of the method of milling employed. The success attending the efforts of the Department of Agriculture in Burma to increase the area cultivated with selected varieties of padi suitable for milling, and the increased profit accruing to the cultivator by the cultivation of such improved seed is of particular value, and finds its counterpart in the work of our Department of Agriculture in the main padi-growing areas of this country. The comparison between Burma and Malaya shews that work in the latter country is proceeding on right lines, and although less advanced than in Burma, is already proving of financial benefit to the growers, who not only obtain heavier crops by the use of selected seed, but are offered a premium for their crop by the local millers.

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* Special Bulletin, General Series No. 8. 1932. (Out of print.)

Original Articles.

THE RICE INDUSTRY OF BURMA*

BY

H. PARKER,

Manager, Government Rice Mill, Bagan Serai, Perak.

On the assumption that the world's area under rice is in the neighbourhood of 200 million acres, the area of 12½ million acres in Burma is equivalent to about 6 per cent. of the total, but, on account of her surplus of approximately 5 cwts. per head of population, she exports about 45 per cent. of the total rice that enters international trade. Although Burma holds a dominant position as regards quantity, she has within recent years lost some of her markets, particularly in Europe, to higher grade rices produced in Italy and America, while at the same time she is experiencing increased competition from Indo-China and Siam in eastern markets.

Rice is by far the most important crop in Burma, covering 75 per cent. of the cultivated area. It is on the rice crop that the prosperity of the country very largely depends, as 70 per cent. of the population are engaged in rice cultivation and trade, and it is the main source of revenue to Government.

Embankments and Canals.

In Lower Burma embankments are necessary in some tracts for the protection of crop against floods, and canals are required either for communication or for drainage purposes.

Climate.

Burma has essentially a monsoon climate and is entirely dependent on the South-West Monsoon for its rainfall. The rainy season lasts from about the middle of May till the middle of October. The remainder of the year is almost rainless; this enables the cultivator to harvest his padi and store it in a good dry condition.

Rice-growing Areas.

The main physical factors that have determined the distribution of padi cultivation in Burma are rainfall and soil, as it is a crop which requires a large amount of water, and the soil and subsoil must be of sufficiently close texture to enable water to be kept on the fields to a depth of 3 to 6 inches throughout the growing season.

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* Report of a visit to Burma in November 1934, to investigate particularly the rice-milling industry in that country.

Over 80 per cent. of the crop is produced in Lower Burma where the crop is almost entirely dependent on rainfall, and it is from Lower Burma that the whole of the exportable surplus comes.

Classification of Grain.

A system of classification which takes into account grain characteristics has been adopted by the Department of Agriculture. The rices have been divided into five main groups as shewn below, with the markets to which the rice is sold.

	Classification.	*Main Markets.*
A.	Emata	Europe and India.
B.	Letywezin	All eastern markets.
C.	Ngasein	Europe, Cuba and Straits.
D.	Midon	Europe, Straits and local consumption.
E.	Byat	Europe and India.

Cultivation.

Cultivation commences as soon as the first showers of the monsoon have softened the land sufficiently to enable the plough to penetrate the soil. As this requires in Lower Burma 4 to 6 inches of rain spread over a period of 7 to 10 days, ploughing usually commences about the end of May or the beginning of June. The general practice is to transplant padi, but in some tracts where labour is scarce, or in cases where the crop cannot be planted in time, the seed is sown by hand. Transplanting in Lower Burma is general by the middle of July and is usually over by the middle of August, except in late tracts where it is necessary to wait until the August floods—which are common in low-lying areas—have subsided.

Harvesting.

At the end of the rainy season in Lower Burma, stormy weather with high winds, which may lay the crop flat in all directions, is often experienced. To prevent this and to facilitate reaping, it is a common practice when the water in the fields begins to dry up, to flatten out the crop in one direction with a long bamboo pole 12 to 14 feet in length. Reaping is always done by hand using the same method as in Malaya.

Threshing.

The threshing floor is generally a padi field scraped smooth, and plastered over with cattle dung and clay to give a hard and smooth surface. The threshing is done by bullocks treading on the grain; the process is slow, the out-turn of grain per pair of bullocks being from 350 to 400 lbs. in a nine-hour day. It is impossible to prevent the grain thus threshed becoming mixed with mud, bits of straw and animal excreta; on this account it has to be screened and winnowed before it is sent to the mill or sold to a broker.

When the crop is winnowed, the grain is heaped up on the threshing floor, and, after the cultivator has laid aside his requirements to provide food until the following harvest, and to pay his rent and the wages of his labourers, the surplus is generally sold off the threshing floor to padi dealers.

Yield.

The average yield per acre in Burma is similar to that of Siam, *i.e.* about 1,500 lbs. or 270 Malayan gantangs. The aim in Burma is not only to produce high yields but also uniform grain—uniform not only in its behaviour in the field but in its physical characteristics on milling, and its appearance.

Cost of Cultivation.

It was very difficult to obtain accurate information on the costs of cultivation; cultivators keep no accounts, and some work their holdings themselves with their own cattle and the help of their families, while others engage labourers and hire cattle.

Disposal of the Crop.

The padi market for the new crop opens about the middle of December and the greater part of the marketable surplus is sold by the actual growers within the next four months. Land-owners, who always collect rents and frequently debts from their tenants in kind, traders and speculators store considerable quantities in godowns along the main railway lines and waterways till later in the year in the hope of a rise in price.

The bulk of the crop is sold off the threshing floor to middlemen, usually referred to as jungle brokers, who travel from village to village buying padi to sell later in the year to big mills in Rangoon or small millers in the districts. The writer understands that it is quite a common sight, during the months of February and March, to see large heaps of padi, often amounting to 1,000 to 2,000 tons, at collecting points awaiting transport or a rise in the market.

Measuring Baskets.

Padi is sold by the 100 baskets. The standard Government basket is 9 gallons capacity but its use is not enforced in private transactions. The village basket varies from district to district from about 8½ to 9 gallons capacity holding from 44 to 54 lbs. of padi. The size of the basket may vary in some villages according to the use that is to be made of it. A small-sized basket is used by the cultivator for paying wages, and, if possible, debts which are to be paid in kind, while the land-owner insists on bringing his own basket to collect rents and debts from the tenants. As might be expected, this variability in the size of the basket is exploited a good deal by jungle brokers buying padi, and, as far as could be ascertained, there is no protection for the cultivator.

Method of Purchase in Big Mills.

The big millers take delivery of padi either at a railway siding or river jetty, but the miller buys on a weight-cum-measurement system. The miller's basket is the Government 9 gallon measure and the basket weight is taken into consideration in paying for the consignment, but he fixes a basic weight of 46 lbs. per basket; for padi weighing over 46 lbs. he pays a small premium, and the price is reduced if it is under this weight. A premium of from Rs. 5 to Rs. 20 per 100 baskets is paid by the millers for padi grown from seed supplied by the Department of Agriculture, but only when the crop is taken direct to the mill. It will thus be seen that very few of the actual cultivators obtain a premium, the person who does obtain it being the large broker or landlord, because the cultivators have little, if any, stocks left for disposal after paying rent, labour charges, and other dues. It is interesting to note that landlords, including chettiars, are taking active interest in the Department of Agriculture seed; many of them not only buy seed for supply to their tenants, but they insist that it should be grown and that rent and other liabilities due to them be paid in the form of padi from such seed.

Padi Godowns.

The method of storage in the mills is entirely different from that practised in Malaya; the padi is stored in bulk in godowns, the floors of which are covered with a flooring of plaited bamboo, a commodity which is much cheaper in Burma than in Malaya.

This type of floor seems to be very suitable for Burma because the mills do not store padi for long periods.

Pure Padi for Sale.

The disposable surplus of pure padi was estimated to amount to 3,409,470 baskets in 1934, and particulars as to where it was available were supplied to all Chambers of Commerce and rice firms by the Department of Agriculture. The result was that a demand was created and the cultivators found that a much readier sale could be obtained for padi which was freed from red grains, and of uniform size. The Department of Agriculture co-operate with the large millers to ensure adequate supplies of reliable padi of uniform quality and type, knowing that there is always a market for a really good product if continuity of supply and quality can be relied on, and assuming that prices, having regard to quality, are competitive.

Milling.

The rice mills in Burma may be divided into two classes:—

(1) The large mills at the export towns owned by Europeans, Chinese and Indians, who mill entirely for the export trade; there are about 44 of these mills in Rangoon and suburbs. The output of the large mills is from 1,000 to 1,500 tons of padi per mill per day of 24 hours.

(2) The small mills in the districts owned mainly by Chinese, Indians and Burmese, who may sell their rice to export merchants in the ports, or to merchants elsewhere for local consumption. A large number of these small mills, however, mill for hire only, the rice being used for local consumption; there are about 400 of these in Lower Burma. The rice mills are chiefly of British, German, and local make and the method of milling similar to that of Malaya.

Qualities of Rice.

For the European markets, No. 1, No. 2 and No. 3 are milled. No. 1 is the highest quality of rice milled and polished in Burma from specially selected quantities of grain of uniform size, shape and hardness. It contains less than 15 per cent. broken grains and is milled to give it a fine polish. No. 2 is also milled from specially selected grains usually of the same type but is not generally so bold as No. 1 and it contains up to 20 per cent. of broken grain. No. 3 is much the same as No. 2 but has not been polished to the same extent. For eastern markets, Big Mills Specials, Small Mills Specials, and Straits Quality are the main grades exported. The Big Mills Specials is the lowest grade exported and contains up to 42 per cent. broken rice. It is in demand mainly in India and the Netherlands Indies. Small Mills Specials is milled from a better quality of grain and contains about 40 per cent. broken rice; it is sold mostly in India. Straits Quality is of better quality having only about 37 per cent. broken grain. It is, as its name suggests, exported mainly to Malaya for the Chinese population, and is also exported to Cuba.

Quite a considerable quantity of "Loonzain" or "Cargo Rice" is milled. It is really shelled rice containing from 2 to 5 per cent. padi and 10 per cent. broken rice. As the husk is 20 per cent. of the weight of the full padi grains, this weight is saved in shipment when it is sent to Europe to be milled up to the required degree of finished white and highly polished rice. Parboiled rice constitutes about 15 per cent. of the total exports and is the most profitable rice to mill having the following advantages: the grain is shelled with the greatest possible ease, being toughened by the boiling process; it can be subjected to severe milling without loss from breakage; and it can be stored for a longer period than white rice. The demand for this rice comes from India, Ceylon, and Malaya for plantation labourers.

As stated previously, the method of milling in Burma is much the same as in Malaya, but in comparison it is much more simple for the miller in Burma on account of the standard type of padi. Rice is sold on sample and certain standards, which are known and accepted all over the world; the specifications are printed and published from time to time by Associations of Millers and Exporters, and the miller is able to buy such large quantities of padi of regular uniform grain that he can repeat or mill the same standard of rice whenever he receives an order.

The writer visited about 100 mills in Burma with outputs ranging from 8 to 100 bags of rice per hour. The mills producing the best rice in proportion to the quality of padi were found to be those with outputs ranging from 8 to 30 bags per hour, and mostly under European or Chinese supervision. The machinery in these mills is of modern type, and mostly of German manufacture. It was the custom in past years in Burma to erect large mills capable of dealing with 700 to 1,000 tons of padi per day per mill. As such mills increased in number, it manifestly became more difficult to ensure supplies of regular uniform padi, with the result that in certain cases the quality of the product suffered. Of late years the tendency has been to erect mills of such moderate capacity as to ensure a steady supply of a uniform variety of padi, to enable the miller to produce the standard rice required. It is unnecessary to make comparisons between the work which has comparatively recently been commenced in Malaya, and what has been accomplished over a period of years by the Department of Agriculture in Burma, with its 12,000 acres of land under experiment stations. These experiment stations have been organized over a period of years, for pure line selection, for hybridization, and for seed-growing, and the results have justified the expenditure of much time and money.

Rice grown in Malaya connot, for many years to come, command the same price as selected Siam or Burma rice, but it can attain a very much higher standard than it has so far reached. Much of the objection which exists to Malayan rice results from using mixed seed. Not only is the outward appearance of the white rice unsatisfactory, on account of the lack of grain uniformity, but the difference in resistance of one variety compared with that of another tends to breakage in milling. Some varieties have a white kernel throughout, while the kernel of others is surrounded by a red cuticle; all the varieties lack uniformity in size, shape and hardness, which causes excessive breakage in milling. Finished rice, to command a good price, must not only be uniform and of good colour, but it must be free, as far as possible, from broken grains; when this aim is achieved the miller will receive a better price for his rice, and be in a position to pay the cultivator more for his padi.

The writer was very interested and impressed by the method of seed distribution in Burma developed by the Department of Agriculture, the success of which has been considerably helped by close collaboration with the leading rice millers, and the paying of premiums. There are about 122 Seed Farms; these farms are divided into two classes—Major and Minor Farms, and the storage accommodation is provided by the tenants under the supervision of Agricultural Assistants, and all the seed produced every year is tested for purity and quality before it is distributed for seed purposes. A rebate of up to 20 per cent. is given on the rent when seed of over 99 per cent. purity is produced, and the seed has to be stored by the tenants until it is required for distribution by the Department of Agriculture. It was authoritatively stated that some of the principal mills which bought quantities of these improved strains were able to pay premiums of

Rs. 20 or more per 100 baskets for the grain. The cultivators obtain this seed from Agricultural Assistants in each district and pay for it in cash at a fixed rate, although in special cases seed may be advanced on credit on the completion of a security bond.

Acknowledgments.

The writer takes this opportunity of acknowledging the courtesy and assistance shewn to him during his visit to Burma by the Chief Secretary, the Director of Agriculture and the Deputy Director of Agriculture. Such assistance, and the facilities so readily placed at his disposal, were of great value in prosecuting enquiries regarding the rice industry in Burma.

THE COPRA INDUSTRY OF THE BRITISH SOLOMON ISLANDS

BY

H. T. PAGDEN,*

Rice Research Entomologist.

The British Solomon Islands Protectorate lies between the 5th and 12th parallels of South latitude and extends for some 900 miles from north-west to south-east. There are six large islands and numerous small ones. The islands are densely wooded and some of them rise to a considerable height, Guadalcanal having one peak of over 8,000 feet and the small island of Kolombangara, some 15 miles in diameter and almost circular, rising to 5,600 feet. Peaks of 3,000 feet are not uncommon and all are densely wooded to the summit. Many of the islands have fringing coral reefs and there is a barrier reef along the north-eastern coast of New Georgia and the eastern coast of the adjoining island of Vángunu, and on this coral-islets rise to 100 feet or more. A similar, but less impressive, reef runs along the opposite coast of New Georgia. These two reefs each enclose extensive lagoons, the latter the Roviana Lagoon, the former the very extensive Márovo Lagoon, perhaps one of the most beautiful places in the world. Some 180 miles north of the main chain of islands lies the large atoll of Ontong Java, also known as Lord Howe Atoll, the inhabitants of which are Polynesians, their language being said to resemble Maori. Polynesians are also found in Sikaiana, Tikopia at the extreme south-east of the group, Rennell and Bellona Islands. The remainder of the population consists of Melanesians, of whom there are some 89,500, the Polynesians numbering only about 3,800. The Melanesians vary in colour from ebony black to chocolate and have fuzzy hair, the darkest natives being those from the Western Solomons, Choiseul and the Shortland group, also New Georgia and the surrounding islands.

The headquarters of the Government are situated on the small island of Tulagi, some 3 miles in circumference, lying off the south coast of Nggela or Florida Island.

Travelling from one island to another is accomplished in small vessels, which are usually of about 10 tons, though some are smaller and others are as much as 30 tons. Most of these vessels are equipped with auxiliary engines. There are also two vessels of about 80 tons each, steel built and equipped with diesel engines.

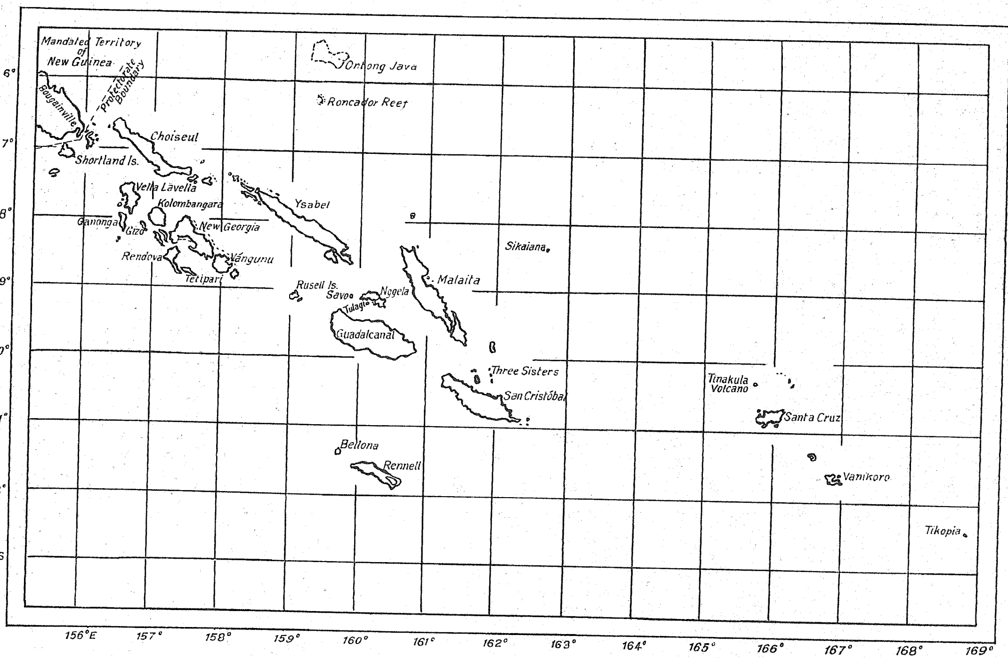
Climate.

The rainfall is generally distributed throughout the year, with rather heavier precipitation from October to March. August is generally the driest month in Tulagi (Government headquarters).

Except for a rather dry zone on Guadalcanal, where some of the poorest coconut estates are situated, the rainfall in the planted areas ranges from about

* The author was seconded to the Solomon Islands, as Senior Entomologist, for a period of two years. These notes were compiled at the termination of this period.

BRITISH SOLOMON ISLANDS PROTECTORATE



85 to 150 inches per annum. In the dry zone mentioned as little as 45 inches has been recorded on one estate. Three Sisters, off the coast of San Cristóbal, had an average of 190.6 inches over the 19 years from 1916 to 1934, with a maximum of 262.4 in 1934 and a minimum of 113.3 in 1920. The writer never visited these islands but understands that the soil is well drained and able to cope with this very heavy precipitation.

The best yielding coconut estates are situated in the Russell Islands and have a rainfall in the neighbourhood of 120 inches per annum.

The humidity in Tulagi averages 82 per cent. and varies from 75 to 87 per cent.

The Solomon Islands lie outside the hurricane zone but high winds and bad storms are sometimes experienced, usually during the months of October to March.

A south-east wind blows from about April to September and a north-west wind from October or November to March. The latter period is generally looked on as the rainy season; heavy rain and electric storms are frequent, and the sea is generally more disturbed than during the south-east season.

The writer has never heard complaints of damage to extensive areas being caused by wind but has several times encountered cases of isolated palms which had broken off at about 8 feet from the ground, though no cause of weakness at the point of fracture could be detected.

One active volcano, Tinakula, lies to the north of Santa Cruz, and the island of Savo, about 20 miles west of Tulagi, is said to have been in eruption within living memory. Fumaroles are found on this island and there is an extensive area of fumaroles and solfataras on Vella Lavella Island.

Earthquakes are not infrequent and may be severe.

Soils.

Both igneous and coralline rocks are found and coral outcrops occur on some islands (1). The writer has seen such outcrops several hundred feet above sea level and several miles inland. In the Russell group high coral cliffs are found and even more remarkable cliffs are found round New Georgia Island, many of them being part of the barrier reef surrounding the island and rising to as much as 200 feet.

In an article on soils in the Protectorate, Lever (2) gives tables of analyses from three localities, the first two being from the Imperial Bureau of Soil Science, the third from the Waite Institute, Adelaide. They are reproduced here.

Comment is made (see Table I) on the high amount of clay compared with silt, and on the low value for water-soluble salts and acid-soluble CaO, K and P_2O_5. Iron and manganese are high; nitrogen, organic matter and pH value are all satisfactory.

It is suggested that artificial manuring would not be satisfactory on account of the large amount of clay, nor would green manuring or liming be likely to prove profitable.

From an estate on Guadalcanal Island three samples were taken from good and poor yielding areas and from an unplanted area (see Table II).

Table I.
Analysis of four Samples of Soil from Malaita Island.

Taken to a depth of two feet.

	No. 1	No. 2	No. 3	No. 4
	per cent.	per cent.	per cent.	per cent.
Silt ...	13.6	5.8	5.8	7.8
Clay ...	61.0	75.1	73.3	83.3
CaO soluble in HCl ...	0.30	—	0.22	0.21
K do. ...	0.04	—	0.03	0.06
P_2O_5 do. ...	0.24	—	0.30	0.41
P_2O_5 available ...	0.003	—	—	—
Nitrogen ...	0.22*			
Organic Matter ...	3.64*			
pH value ...	6.9	6.8	6.7	6.5

* Top soil only.

Table II.
Analysis of Three Soils from Guadalcanal Island.

	Poor		Good		Unplanted	
	Top Soil	Soil at $3\frac{1}{2}$ ft.	Top Soil	Soil at $3\frac{1}{2}$ ft.	Top Soil	Soil at $3\frac{1}{2}$ ft.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Coarse sand ...	6.7	30.8	69.3	88.9	4.6	6.0
Clay ...	35.7	34.2	10.2	5.7	36.6	31.5
CaO soluble in HCl	1.42		0.86		1.01	
P_2O_5 soluble in HCl	0.19		0.22		0.17	
P_2O_5 available ...	0.04		0.10		0.02	
K do. ...	0.16		0.05		0.15	
Na do. ...	0.01		0.01		0.02	
Nitrogen ...	0.32		0.12		0.18	
Organic Matter ...	9.82		3.82		11.44†	
pH value ...	6.9	6.8	6.9	6.8	6.5	6.7

† Figure high due to free carbon from burnt grass.

The author remarks, concerning these analyses, that the soil with an average of 79.1 per cent. coarse sand is likely to be more suitable for coconuts than that with an average of only 18.7 per cent., but that both soils should be good provided that the water supply is adequate. Chemically, the phosphate deficiency is not great, and exchangeable potash, nitrogen and organic matter are considered satisfactory.

The third locality has a soil of quite a different type, but no mechanical analysis is given. The chemical analysis is shown below.

Table III.
Analysis of Soil from Russell Islands.

Samples taken at depth of 1 ft. 2 ft. and 3 ft.

	1 foot	2 feet	3 feet
	per cent.	per cent.	per cent.
Organic carbon ...	1.82	1.36	1.20
Nitrogen ...	0.16	0.13	0.12
K soluble in HCl ...	0.04	0.03	0.03
P_2O_5 do. ...	0.08	0.11	0.11
pH value	5.5 to 6 in all cases.		

While nitrogen and phosphoric acid are fairly satisfactory, potash is very low and the soil is rather on the acid side. Nevertheless, the estate from which the samples were taken is a consistently high-yielding property.

To the foregoing some brief notes on the general appearance of the soils, as they struck one who is not a specialist, may be of interest.

The estates seen on Malaita Island may be characterized as consisting of very heavy clay, which, in many places, is often in a waterlogged condition. On Guadalcanal the soil varies from a sandy nature with some basalt and, in places, alluvium and gravel, to clayey loams with some coral outcrops. In the Russell Islands the soil appears to be a rich chocolate loam with coral outcrops. One of the estates on Kolombangara Island has soil varying from yellow to red, with a certain amount of black iron sand on the foreshore. Another estate on the same island has the whole foreshore of a similar sand, but extending for a considerable distance inland where there is a coral reef lying just beneath the surface indicating a previous shoreline; the rest of the estate has a soil of clayey nature, as is indicated by its generally waterlogged condition, in spite of numerous drains. Further round to the south-east on the same island there is an estate with many

large ironstone boulders embedded in the soil, and there are also hillocks with much broken weathered coral, the appearance of the coral suggesting that it has been subjected to volcanic action, and this is probable as the island is an extinct volcano and there are several small crater-like cavities on the estate in question.

An estate on the north-east end of Rendova Island is situated partly on the mainland and partly on small coral islets which rise from the fringing reef; this estate is of particular interest in that the palms on the islets are growing on almost pure coral with hardly any soil. On the only one of these islets which was visited by the writer the crop was very good indeed, the crowns of the palms being crowded with nuts. On one palm 126 nuts were counted from the ground, using field glasses, and all were nearly fully-developed and nearing ripeness; the number must have been greater than this as many nuts were hidden by others below. The region where this estate is situated is much subject to earthquakes of a violent nature; apparently the palms do not suffer in any way from these disturbances.

Another remarkable estate is a small privately-owned holding of only 20 acres, not more than about 18 acres being planted with palms. This estate is situated on an extraordinarily hard shelly limestone, descending for at least 12 feet and with only a few inches of soil on the surface; in spite of these seemingly unsuitable conditions the palms yield the astonishing crop of more than a ton of copra per acre, 20 tons being regularly harvested annually from the planted area. The planting is at 40 feet spacing on the square.

Lying to the east of New Georgia Island is the extensive Márovo Lagoon, in which are hundreds of small coral islets, most of which carry their quota of coconut palms; many of them have been planted and are worked by white people. The area is remarkable for the fact that the palms are growing on almost pure coral rock and most of them are bearing well, though some have fallen off in production recently. In one case 12 cwts. per acre have been harvested annually for 20 years. There seems to be scarcely any soil in the form usually understood by this term. Similar conditions are found elsewhere to a less extent on the reef-islands round some of the large islands.

On the small island of Savo, nearly circular and some 18 miles in circumference, there are palms growing and bearing well at over 1,000 feet near the lip of the old crater, and palms bearing good crops were seen at about 2,000 feet on Kolombangara Island.

On Vella Lavella Island the soil appears to be a sandy loam; most of it is undoubtedly of volcanic origin and there is still a considerable amount of thermal activity on the eastern side of the island. One estate visited had a coral foreshore followed by an abrupt rise of about 80 feet to a plateau, where the soil appeared to be a rich sandy loam varying in colour from red-brown to dark chocolate, with a considerable amount of well-weathered coral at a depth of 3 to 4 feet. Though the conditions seemed to be ideal for coconuts, and the rainfall was within the limits of that found on the best estates in the Protectorate, the estate was practically barren over the whole of its 500 acres. Further along the

coast in both directions the plantations were bearing moderate to good crops, though one, where there was a good deal of black iron sand, was on the poor side.

The most consistently good-yielding estates are those situated in the Russell Islands, where crops range from 10 to 15 cwts. of copra per acre, one estate giving a crop of the latter figure over the whole area of some 3,000 acres.

The Plantation Coconut Industry.

The plantation coconut industry in the Solomon Islands has existed since the early part of the present century. Previously one or two traders were established in the Islands and these owned coconut groves and did some trade in copra.

At the present time there are three main coconut planting companies operating in the Islands. Plantations vary from about 300 to 3,000 acres, the largest individual estate being in the Russell Islands.

The largest coconut planting company owns estates on Guadalcanal Island, in the Russell Islands (Banika and Pavuvu Island), on Kolombangara Island, Rendova Island and on various smaller islands and islets.

Another company has its largest estate in the Russell Islands. It also owns properties on Malaita Island, and has recently acquired several estates on Guadalcanal Island.

The third company has its principal properties on Guadalcanal and Shortland Island, and also has a large estate on Montgomery or Tetipari Island.

A certain number of privately-owned estates is found in the various islands, some being quite small, about 20 acres, while others are as much as 500 acres.

In addition, copra is purchased by traders from native groves.

Methods of Cultivation.

The system of coconut cultivation practised in Malaya finds no counterpart in the Solomon Islands. In the latter country, soil cultivation is not general, and although weeding is carried out in some instances, in many cases reliance is placed on the use of cattle to keep the undergrowth in check. Weed growth, however, is rapid, rendering control by grazing cattle inadequate and resulting in many instances in a fairly dense undergrowth, which may attain a height of six feet or more.

Recently, attempts at surface cultivation with rotary hoes have been made; considerable labour has been expended in removing large boulders, partially embedded in the soil, before the hoes could be used, but many large boulders were encountered beneath the surface when the hoes were put into action. It is too early yet to say whether any beneficial results will accrue; having had no previous cultivation the roots of the palms are very near the surface and were cut by the hoe and it would seem likely that an initial set-back may occur before any improvement can be seen.

Perhaps the commonest weeds are *Sida rhombifolia*, known locally as Paddy's Lucerne (better known elsewhere as Queensland Hemp), a large leaved shrubby *Ficus* (*sensu lato*), *Mimosa pudica*, which grows very rank, and the grasses

Chrysopogon aciculatum, Stenotaphrum and *Paspalum conjugatum,* while on certain estates ferns and sedges are noticeable amongst the undergrowth. One plantation, more or less abandoned, was almost choked with *Stachytarpheta,* locally known as blue rat-tail. *Lalang* grass also occurs, and where this or *Chrysopogon* is found the palms are generally poor or almost barren. The latter grass will generally suppress any low-growing cover and most other grasses. In some cases, attempts have been made to establish *Desmodium triflorum,* a low growing clover, but where *Chrysopogon* occurs this has always failed. There is, however, a small creeping grass, somewhat like a minute *P. conjugatum,* which seems to be able to suppress *Chrysopogon,* and this grass may in turn be suppressed by *Desmodium.* The grass was first seen by the writer on Bilua Mission Station, Vella Lavella Island. It was brought from Choiseul Island and quickly established itself in the place in question, suppressing the pre-existing growth of *Chrysopogon.* All attempts at establishing *Desmodium* had failed until that time but this plant soon followed the imported grass. The writer saw the place when covered with *Chrysopogon* and after the *Desmodium* had become established, but not in the intermediate stage.

Centrosema and *Pueraria* were planted in two small adjacent plots on one estate. *Pueraria* did not succeed against the existing growth, which was cut before sowing the cover, but the *Centrosema* overwhelmed any new growth which was put up by *Mimosa pudica* and *Sida rhombifolia,* the two plants previously present. No attempt was made to keep it away from the palms, however, and it ascended the trunks for a considerable distance. The ensuing damp conditions caused a superficial rot, and ants, *Pheidole megacephala* Mayr, tunnelled the tissue and nested.

Preparation of Copra.

The crop is collected from the ground, the nuts being split with an axe and the meat cut out with a knife and rammed into a bag in the field, the bags often remaining in the field for several hours before they are collected and taken to the dryer.

One or two estates dry in the half nut, usually in the husk, but sometimes after husking.

In all cases drying is far too rapid according to Malayan standards, the product usually leaving the dryer in 24 hours or less. The resulting product is of poor quality and is much subject to attack by fungus and insects, and may become slimy on storage. Frequently, copra which appears good when it comes out of the dryer deteriorates and becomes rubbery on storage. This is possibly due to a case-hardening due to too rapid drying.

Some estates have tried to improve the quality of their copra with some measure of success, but this is a recent development.

The New Guinea type of dryer is used to a considerable extent by one firm, who also use steam dryers on some of their estates. In the former type the meat is spread on trays carried on runners and arranged in tiers; hot gases from the

fires, invariably fuelled with jungle timber, pass through flues under the tiers of trays and a considerable temperature is reached. In the steam dryer, the steam is carried in pipes from the boilers and passed through the building. The product may be of rather a better quality than that usually obtained from the New Guinea dryer, but still leaves much to be desired, probably due to rapid drying.

Nearly all small estates use the smoke dryer, usually of a very inefficient type. Little attention is paid to draught exclusion and, as timber is used for firing, much smoke is produced and the copra is discoloured. In some cases shell and husk are used for firing, but there seems to be a rooted objection to this fuel, the reason given being that corrosion of the ironwork of the firebox is more rapid than with jungle timber. Perhaps this would not occur if dry shell alone were used, the husk, and a good deal of moisture, possibly being responsible for the trouble.

Recently a dryer known as the Buka dryer, the invention of a Mr. Drummond-Thompson of Kieta, Bougainville Island (Mandated Territory of New Guinea), and presumably named after Buka Plantations Ltd., has gained some measure of popularity, and one company was installing a number towards the end of 1934 and in early 1935. Briefly, the dryer consists of several tiers of wire mesh trays beneath which run two flues constructed of old 40 gallon crude oil drums riveted together end to end; the flues run parallel and are fired at opposite ends.

The writer saw a modification of this dryer on an estate on Malaita Island. Only one fire was used and the hot gases were passed along a flue which had two leads at right angles on either side, thus considerably increasing the heating area; the flues were constructed of crude oil drums as in the original but were enclosed in an outer casing pierced by a number of holes on the top, the idea being to conserve heat; the unit was well enclosed in an *attap* shed and the top ventilation could be controlled by raising or lowering the jack roof. At the commencement of drying the jack roof was raised to liberate moisture, but when the atmosphere became fairly dry it was lowered to increase the temperature. Drying was stated to take about 17 to 23 hours*.

Recently some attention has been paid to washing the fresh meat in sea-water before drying. The writer has not seen copra treated in this manner but it is claimed that the quality is much improved.

One remarkable dryer seen consisted of a large iron box, almost as large as an ordinary room, with a smoke vent at each corner. The fire was lighted in the box; husk and shell which had been stored in the dryer, and was thus fairly dry, being used for fuelling, and the half nuts, in the husk, stacked on top. Drying was carried out for about 24 hours, but usually a certain proportion of insufficiently dried half nuts were put back with the next charge.

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* A brief article on copra drying, with special reference to the Solomon Islands, appears in the *British Solomon Islands Agricultural Gazette*, Vol. 3, No. 2, April 1935.

Labour.

The labour usually employed is Malaita natives as these seem to be the best workers and the island is the most densely populated in the group. A regular trade is done in recruiting. The labourers are usually indentured for two years.

A few estates employ local labour from the neighbouring villages, but this is not always satisfactory, the attractions of the village and the fact that they are near home tending to make the labourers less manageable.

As far as the writer's recollection serves 30 to 50 labourers are considered sufficient for an estate of 1,000 acres. On some estates the proportion is greater, while on others it is considerably less than the figure quoted. In the Russell Islands, where the estates are generally cleaner than elsewhere, more labourers are employed than in the majority of cases. The least number of labourers to an estate was seen on a place of about 1,000 acres where only 14 natives were employed. The small private owner is generally quite unable to employ sufficient labour to run his estate efficiently.

Labourers were paid £1-0-0 (Australian) per mensem, but this is now reduced to 10s. (Aust.). Rations, clothing, a blanket, mosquito net, tobacco and quarters are all supplied free. Rations include: daily, 1 lb. rice and three ship's biscuits (flour and sharps may be supplied in place of biscuits); weekly, 2 x 12 ozs. tins meat, 1½ lbs. sugar, tea as required, 3 sticks of trade twist tobacco, and matches. These conditions apply to all boys, whether labourers or house boys.

Volume of Trade.

Exports of copra for three years are shewn in the following table.

Table IV.

Exports of Copra from the Solomon Islands.

Period	Copra Tons	Value £
1 April 1931 — 31 March 1932	21,209	137,843
1 April 1932 — 31 March 1933	22,256	153,426
1 April 1933 — 31 March 1934	21,119	70,379

A good deal of the copra produced is shipped to Australia. One company ships most of its product to Europe and some of the private owners have done the same by selling direct to agents.

A Norddeutscher Lloyd cargo vessel comes from Hong Kong *via* the Philippines and New Guinea about once a quarter.

In addition, copra boats call at irregular intervals, advice generally being received by wireless some time before their arrival.

Another firm, with headquarters in New Guinea, owning coconut estates and having a financial interest in others, runs its own vessels, supplementing the produce from its estates by purchases from other local producers.

References.

1. Lever. *British Solomon Islands Agricultural Gazette*, Vol. 1, No. 2, p. 3.
2. Lever. *British Solomon Islands Agricultural Gazette*. Vol. 3, No. 2, pp. 13-14.

Reviews.

The Coconut Industry of the Philippine Islands.

F. C. Cooke. 101 pp. 15 plates and 1 map. Special Bulletin, General Series No. 23 of Department of Agriculture, Straits Settlements and Federated Malay States, 1936. Price 50 cents Straits currency, post free.

The Philippine Islands are the most important exporters of coconut products in the world. The Islands are estimated to contain 1,480,000 acres under this crop, yielding 2,165 million nuts of which 388 million nuts are consumed within her borders and 643,000 tons of copra and oil (expressed in terms of copra) exported, worth 36 million dollars in Straits Settlements currency. Thus she exports 33 per cent. of world exports of coconut products, as compared with the Netherlands Indies 26 per cent., Ceylon 13 per cent., South Seas 10 per cent. and Malaya 8 per cent.

This great export trade is not only due to her enormous area under coconuts, but to the fact that the local consumption, though it appears great, is small in comparison with other coconut-producing countries. Thus, while the consumption per head in Ceylon is 250, and in Malaya 110, in the Philippines it is only 31.

These statistical data, extracted from the publication under review, not only emphasize the importance of the Philippines in the copra market, but justify the visit of the author to the Philippine Islands for the purpose of studying the conditions of the industry. Mr. Cooke, as Officer-in-Charge of Copra Investigations in Malaya, was well-qualified for this task, and the careful manner in which he has examined the situation in that country will be of value to his work in Malaya, while we venture to predict that the bulletin will be appreciated in other countries, and in the Philippines in particular, as an unbiased review of the situation by a trained observer.

The report is divided into nine sections, in the earlier of which the author gives an account of the conditions under which the crop is grown, systems of land-tenure, distribution of area, and the history of the growth of this important industry. Subsequent sections deal with methods of cultivation practised, and the manufacture and marketing of copra. This latter subject is particularly well illustrated to shew the types of kiln in general use and their method of construction, while the letter-press deals adequately with the quality of copra produced, its storage, grading and marketing.

While the bulk of the crop is exported as copra, the local production of coconut oil for export and for local consumption has increased considerably in the past few years, and efforts are being made to encourage the local consumption of copra by the production of cooking oil and edible fats, soap and desiccated coconut.

One section is devoted to a review of the economic conditions of the industry, in which consideration is given to capital value, cost of production, and the various methods adopted or under consideration by the Government, designed particularly with the object of making the livelihood of the grower more secure. The final section reviews the copra market in 1934 with special reference to the Philippines. It is largely an historical review of the tariff legislation in the United States of America and its effect on Philippine trade.

Throughout the report, emphasis is laid less on the present output of coconut products from the Philippines than on the greatly increased production, which may be expected to reach its peak in about 1940 when the large areas of coconuts at present immature come into production. In the latter year the exports are likely to reach 800,000 tons, equal to one-half of the total world trade in coconut products in 1933. The absorption of this increase will, the author states, largely depend on the attitude of the United States of America. If the United States of America cannot, or are unwilling to encourage the increased use of coconut oil in that country, there must be a gradual fall in world prices, possibly to a figure at which high-cost producers could no longer compete.

The author appears to consider that, while prices may be maintained by closer working agreements between countries, crop diversification appears to offer the best prospect of alleviating distress amongst small-holders in the coconut areas, not only in the Philippines, but elsewhere.

D. H. G.

A Dictionary of the Economic Products of the Malay Peninsula.

I. H. Burkill, M.A., F.L.S. *2402 pp. Crown Agents for the Colonies, 4, Millbank, London, S.W. 1, January, 1935. In two volumes price 30 shillings.*

This 2,400 page dictionary, which deals with 17,000 different subjects, has taken over ten years to compile and is a model of continuity of effort. As the title page shows, there are contributions by William Birtwistle (Officer-in-Charge, Fisheries Department, S.S. and F.M.S.), Frederick W. Foxworthy, Ph.D. (formerly Forest Research Officer, F.M.S.), J. B. Scrivenor, I.S.O., M.A., F.G.S. (formerly Director of the Geological Survey, F.M.S.) and J. G. Watson (Conservator of Forests, Malayan Forest Service) but ninety-four per cent. of the subject matter was contributed by the author himself.

Although this dictionary deals primarily with the vegetable products of the Malay Peninsula, it also contains information on both animal and mineral products common to Malaya.

The arrangement of the subject matter is such that only the most important information is brought to the front in the text, while marginal notes take the place of the usual sub-headings. In most of the articles comprising the dictionary, reference is made to other authors who have studied the particular subject in closer detail.

As the author states in the preface, the only satisfactory way of treating comprehensively so many widely different subjects is the assembly of the articles in alphabetical sequence; consequently, the subject matter has taken the form of a dictionary.

For the most part scientific names have been adopted for the headings. This is necessary in the case of the vegetable products since so many of the plants described in the work have no common names. There is, however, an index of nearly one hundred pages in which cross references are given of English, Malay and Sundanese (Dutch Indies) names which is available so that the layman will have no difficulty in finding any subject on which he requires information. Incidentally, the index is not altogether perfect, for instance, the *oil palm* is not indexed under this heading, but under the old title of African oil palm, which is now considered obsolete in the East Indies where it has become a most important plantation crop.

The Malay names of many of the plants and plant products have been corrected so far as possible after consulting the works of R. J. Wilkinson, C.M.G. and J. G .Watson on the subject. Some of the names, however, are still open to doubt and this is indicated in the text.

The dictionary was published on behalf of the Government of the Straits Settlements and Federated Malay States by the Crown Agents for the Colonies, and printed in Great Britain at the University Press, Oxford, in the latter's usual inimitable style and finish.

Mr. Burkill held the appointment of Director of Gardens in the Straits Settlements for a period of over twelve years during which time he obtained a wide and intimate knowledge of Malayan flora and this, combined with a botanical training, rendered him the most competent authority to undertake the writing of such an expansive work relating to the economic products of Malaya.

Although the dictionary has taken a decade to produce it will undoubtedly remain a standard work on the subject for many decades to come. At the price of only thirty shillings for the two volumes it is remarkably cheap and the popular way in which it is written will appeal to the layman just as much as it will satisfy the needs of the scientific workers in Malaya living among the flora and fauna described in this great work.

The author is to be congratulated on the comprehensiveness of the book, the general arrangement of the text and, last but not least, the clear and concise way in which each individual subject is treated. Anyone reading the work will

not fail to realize that Mr. Burkill during the ten years of retirement has done a real service to Malaya, and his name, like that of his predecessor, Mr. H. N, Ridley, will live long in the history of Malayan science,

B. B.

Latex in Industry.

R. T. Noble, Ph. D. The Rubber Age (New York), 384 pp. 76 illustrations G$7.

During the last decade investigations on rubber latex and numerous important industrial applications have resulted in a very considerable literature scattered in various journals and patent applications. Two large volumes dealing exclusively with latex have been published during the last three or four years in addition to a special brochure issued by the Rubber Growers' Association. This new publication by Dr. Noble will also be welcomed by all scientific workers and technologists who are concerned with this interesting and valuable product. Dr. Noble is appropriately qualified to be the author, since he has been carrying out investigations with latex with one of the largest Latex Corporations in America and before that was investigating artificial rubber emulsions.

In writing a review of this excellent publication it would be difficult to improve on the encomiums and statements made by Dr. E. A. Hauser in his introduction to the book, especially in view of the fact that Dr. Hauser, as is well known, is one of the world's leading authorities on the subject.

It is unnecessary to deal in detail with any particular aspect of the subject. The book is a *multum in parvo* dealing concisely in Part I with Sources, Preservation and Shipment of Latex, Properties of Latex, Concentration, Artificial and Vulcanized Latex, Compounding, including technique of stabilizing, thickening and wetting, Coagulation of Latex Compositions, Vulcanization and Examination of Latex.

Part II covers technical applications of latex in which various processes are discussed in separate chapters.

An extremely valuable adjunct is the comprehensive bibliography published at the end of each chapter.

This book should be in the possession of all those interested in the production and consumption of latex, in addition to those engaged in scientific investigations on the product.

The producer (planter) will realize, as I am afraid he does not at present, the large amount of important scientific work which is being carried out on his behalf, not only by producers' organizations but by chemists and other technologists engaged in rubber manufactories or by Latex Corporations such as the one in which Dr. Noble is engaged.

The grateful thanks of all latex technologists are due to Dr. Noble for compiling this publication.

The only criticism I have to make is in relation to the weight of the book. For its size, it is I think the heaviest book I have handled, which is due presumably to the use of a heavily loaded art paper for the text as well as for the illustrations. The illustrations, it may be remarked, are excellent.

B. J. E.

Tropical Planting and Gardening.

H. F. Macmillan. Fourth Edition. Published by Macmillan & Co. Ltd., London, 1935. 8vo. 560 pages including glossary and index; 3 coloured plates, 380 half tone and 23 line illustrations. Price 25 shillings.

The appearance of a fourth edition of Macmillan's *Handbook on Tropical Planting and Gardening,* ten years after the previous edition was published, is welcome. The actual number of pages in the present edition is slightly decreased, but the general matter has been added to and revised. An extra chapter is included dealing with suitable plants for, and their cultivation in, Arid or Sub-desert Regions. The illustrations, which are well reproduced, are increased in number and variety.

The book contains thirty-eight chapters which are divided into five sections. Section I deals in a general manner with soils and manures, cultivation, propagation, and the laying-out and upkeep of gardens and grounds in the tropics. A list of leguminous green manures and cover plants is included together with brief descriptions and cultural directions.

Section II is a large one, embracing flowering trees, shrubs, and climbers, herbaceous and other plants, suitable for cultivation at low or medium elevations. The information given, supplemented with numerous illustrations, is of particular interest to the horticulturist. Further chapters are included dealing with ornamental plants and trees for high altitudes, and coastal and dry regions. The chapters on tropical and sub-tropical fruits provide a useful guide to the majority of fruits which may be grown in the East. Chapters XXII to XXIX are concerned with tropical and sub-tropical vegetables and food-crops, spices and condiments. These chapters contain information of considerable value to planters and others in Malaya who may require a reference to little-known crops and trees of economic importance.

The next section (IV) is of general interest to the agriculturist since it includes all crops grown in the eastern tropics. Tea, coffee, cacao, tobacco, coconut and oil palms, rubber, fibres and dye plants, and fodder grass, are all dealt with in

a concise manner. The reference to the oil palm is perhaps the least satisfactory since little advantage has been taken of recent publications. It is unfortunate that the illustration on page 376 of the male inflorescence of the oil palm is inverted. A large number of plants of minor economic importance are dealt with in this section, so that it provides an excellent guide to the lesser-known crops which may be grown in tropical countries. The chapter on Fodder Grasses is a useful one and details similar results to those obtained in Malaya.

Section V is devoted to various perfume-yielding and honey-producing plants known in warm countries. Subsequent chapters deal with pests and diseases likely to occur, with notes on their treatment. The final chapters contain information on the packing of plants for transport and storing seeds. Useful references to recipes for making preserves and weights of various seeds are also given. A comprehensive glossary and an index of fifty-eight pages complete the book.

The new edition of this handbook maintains and enhances the excellence of previous editions and, although written primarily for Ceylon, is suitable for wider application. A considerable reduction in price has been made and it should appeal to many interested in planting and gardening under tropical conditions.

J. N. M.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports submitted by Field Officers.

February, 1936.

February was, on the whole, a month of hot dry weather everywhere, but occasional heavy showers in the second half of the month brought the rainfall up to or slightly above the average in the majority of the inland areas. In Kedah there were strong north-east winds and the rainfall was well below normal as it also was on the greater part of the west and east coasts, except in the Dindings where local showers were frequent.

Remarks on Crops.

Padi.—Harvest was continued under ideal weather conditions in all areas where it had been commenced in January. It was begun during the month in most parts of North and Central Perak, in the Sungei Manik area in Lower Perak, in the Panchang Bedena and Tanjong Karang mukims of Kuala Selangor District, and throughout the State of Kelantan.

In Krian the protracted nature of the harvest has prevented any concentrated demand for labour, supplies of which have been ample and have included numerous Malays from Province Wellesley and Penang Island. Moreover, more owners of padi land are themselves reaping their crops this season as a result of propaganda in past years. In Kuala Kangsar District, padi growers in the riverine mukims say that the crop is the best they have obtained for many years, especially in the areas within the new pump irrigation scheme. Further down the river in Lower Perak District, measured plots showed yields of 570 gantangs per acre in Pulau Tiga mukim and 480 gantangs per acre in Kampong Gajah mukim. Yields in the Sungei Manik area have also on the whole been good.

The good crop in the Central District of Malacca has led to considerable exports of padi to Singapore and Johore, while large supplies have also been delivered to the rice mill at Ayer Lileh. In this Settlement a heavy demand for seed of pedigree strains is again anticipated in the coming season.

In Kelantan the wet padi crop is expected to give a good yield.

The premium of 1 cent a gantang promised by the Bagan Serai Mill Board for supplies of unmixed padi of the strain Seraup 48 is being paid out on all consignments certified by the Agricultural Officer, Krian, to be of a reasonable standard of purity. Up to the end of the month one large estate had supplied the mill with 51,425 gantangs of this padi, while small-holders had received the premium on 49,400 gantangs. In all some 2,700 gantangs were rejected as being below the required standard of purity.

A small power-driven rice mill has been installed by a Malay at Lenggong in Negri Sembilan.

Rubber.—The hot dry weather during the month caused simultaneous wintering and rapid defoliation of the rubber trees throughout the Peninsula.

There was a marked increase in the number of holdings left untapped. This was due to several causes. Preoccupation with padi harvest was one important cause; another was that the quarter's supply of export coupons issued in January was becoming exhausted. This in turn led to high prices for coupons, which were saleable at as much as $28 per picul of export rights in Johore, and to as low a price as $3.50 to $4.50 per picul for rubber, mostly unsmoked sheet, without coupons. The high price of coupons rendered their sale at least as profitable as tapping on properties where hired tappers are employed, while tapping without export rights was quite unprofitable, unless the work was done by the landowner or a member of his family. Reduced yields following on the heavy wintering were an additional discouragement to tapping.

A further matter of interest reported during the month was that although the price of rubber increased, the differences between the prices of different grades of sheet diminished, especially that between smoked and unsmoked sheet of fairly good quality. For example, in North Kedah smoked sheet sold at $32.60 per picul while unsmoked sheet fetched $32 per picul. During recent months this difference has usually been at least $1 per picul and usually $2 or more.

In the dry conditions prevailing, mouldy rot disease gave little trouble. Leaf fall due to *Oidium Heveae* was reported from one or two estates in Negri Sembilan, but was not severe. It was, however, somewhat early for the appearance of this disease, as the trees had barely commenced to produce their new flush of leaves.

Copra.—The rise in the price of copra was maintained in the first half of the month, but subsequently declined by some 70 to 80 cents per picul. Even so it remained high enough, at about $5 per picul for f.m.s. quality, to sustain interest in copra production in all the principal coconut-growing areas. Nut prices did not necessarily decline in proportion to those of copra owing to continued shortage of nuts in some localities. Copra-making recommenced in Kelantan, as the change in the weather permitted of successful sun-drying.

The construction of the coastal bund in Sabak Bernam Sub-district, Selangor, is reported to be having the desired effect. Palms along the coast, which had yellow leaves and an unhealthy appearance, are gradually improving both in colour of foliage and yield of nuts.

Fruit.—Supplies of pineapples continued to decrease; consequently prices for fresh fruit remained high and all factories were reduced to working only once in two or three days. The season for tree fruits was drawing to a close, but duku and rambai were harvested in Selangor, Pahang and Johore, while durians were still fruiting in Malacca. Exports of bananas from Negri Sembilan were well maintained, being estimated at some 33,600 piculs for the month.

Agricultural Stations and Padi Test Plots.

Arrangements have been made for extending the area of the Kuala Kangsar Agricultural Station. The additional land was marked out, certain old coconut and other trees were removed and the land levelled.

Certain coffee bushes at this Station, formerly showing yellow foliage believed to be due to nitrogen starvation, were treated with ammonium sulphate. Those so treated showed a marked improvement as compared with the untreated trees used as a control.

During the month rambutans were successfully budded and about 30 per cent. of success was obtained in budding durians. Extra shade was employed to counteract the effect of the hot dry weather and this seemed to be proving effective.

In Johore work was commenced on the site of the new 30 acre Central Experiment Station at Ayer Hitam. Bush growth on the land was slashed and patches of *lalang* grass were dug out.

Padi harvest was concluded at the Telok Chengai Station in Kedah and on several Padi Test Plots, while it was nearing completion on most other Padi Stations and Test Plots. On the Tanjong Karang Test Plot in Kuala Selangor District Radin 2 gave a yield from multiplication plots of over 500 gantangs per acre, which is good for this locality.

At the Central Experiment Station in Kelantan Radin 4, Seraup 15 and Seraup 36 gave yields somewhat exceeding 600 gantangs per acre, while strains of Radin Siak, a 5 month variety, gave 460 to 490 gantangs per acre.

Agricultural Instruction.

Further demonstrations on the use of the Malacca plough and harrow and of the *tajak* for preparing padi land were given in Lipis District of Pahang. These were well attended and many of the cultivators tried the implements for themselves. Up to the present the *tajak* appears to be the most popular of the three implements. Arrangements have been made to supply departmentally all the implements at cost price and a fair demand is expected.

Headmen from the north-west portion of Krian District visited the Titi Serong Padi Station on February 3rd and were reported to be impressed by the large blocks of Seraup 48.

An important demonstration, at which His Highness the State Commissioner, Muar, and the District Officer, Tangkak, were present, was given at the Tangkak Padi Test Plot in Johore to about 150 headmen from Muar, Pontian and Segamat Districts on the 6th February. Apart from the work in progress, the use of the sickle for harvesting, the barrel for threshing and the winnowing machine were demonstrated and the importance of rat control was stressed. There was an enthusiastic response to the invitation to try any implements demonstrated, while the numerous questions asked provided evidence of the interest evinced.

The Rural Lecture Caravan completed its tour in Selangor on the 3rd and commenced a tour in the Batang Padang and Kinta Districts of Perak on the 9th of February. Large crowds attended at most centres, especially at those which were being visited for the first time.

DEPARTMENTAL NOTES.

Visit of Adviser on Agriculture.

The Adviser on Agriculture visited Fraser's Hill from 22nd to 24th February for the purpose of inspecting the activities of the Department at this hill-station.

Agricultural Journal in the Tamil Language.

In response to a request received from the Malayan Estate Owners' Association, the Department has published this month the first number of an agricultural journal in the Tamil language.

The project has been considered on several occasions during the past few years, but for various sufficient reasons, was not put into effect. Its place has been taken, however, by occasional leaflets in Tamil dealing with particular subjects upon which propaganda was desirable.

The present venture is in the nature of an experiment, doubt having been expressed in several quarters regarding the likelihood of such a publication commanding the attention of those for whom it is primarily intended. The Indian owners of large properties are more often than not able to read English and can, therefore, make use of the departmental publications in this language, whereas the labourers are frequently unable to read their own language.

The Tamil Agricultural Journal will be distributed free to *bona fide* agriculturists. The co-operation of employers of labour and of Indian planters is invited to make this publication known amongst the community for which it is intended. Applications for copies should be addressed to the Editor, Department of Agriculture, Kuala Lumpur, and any constructive suggestions or criticisms will be welcome in order that subsequent issues, if any, may achieve a wider utility.

The following are the subjects of articles in the present issue:—Editorial; Gingelly; Soil Erosion—What it is and how it may be guarded against; Manufacture of Smoked Sheet on Small Holdings; the Quality of Copra; White Ants in Coconuts.

Statistical.

MARKET PRICES.

February, 1936.

Major Crops.

Rubber.—The market shewed a considerable and sustained improvement during February. Spot loose opened in Singapore at 24¼ cents per lb., rose steadily to 26 1/16 by the middle of the month, and closed at 25 9/16. The average price for the month for No. 1 X. Rubber Smoked Sheet was 25.38 cents per lb. as compared with 23.41 cents in January. The average price in London was 7.27 pence per lb., and in New York 15.38 cents gold as compared with 6.76 pence and 14.20 cents gold in the previous month.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, February, 1936.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.				Kuala Kangsar, Perak.			Batu Pahat, Johore.
	6	13	20	27	5	12	19	
Smoked sheet	30.00	31.80			30.40	32.83	33.77	No Sales
Unsmoked sheet	29.00		31.00	31.00				
Scrap		27.00		27.00				

Transport by F. M. S. R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

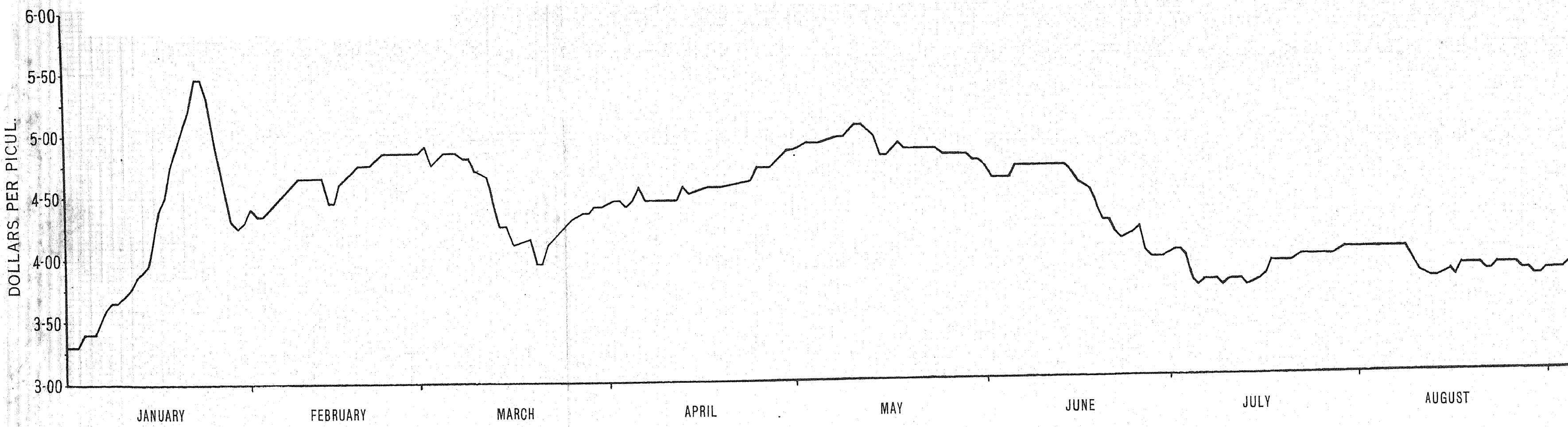
At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent

No purchases at Batu Pahat during the month, and at Kuala Kangsar on the 26th February.

COPRA "SUNDRIED"

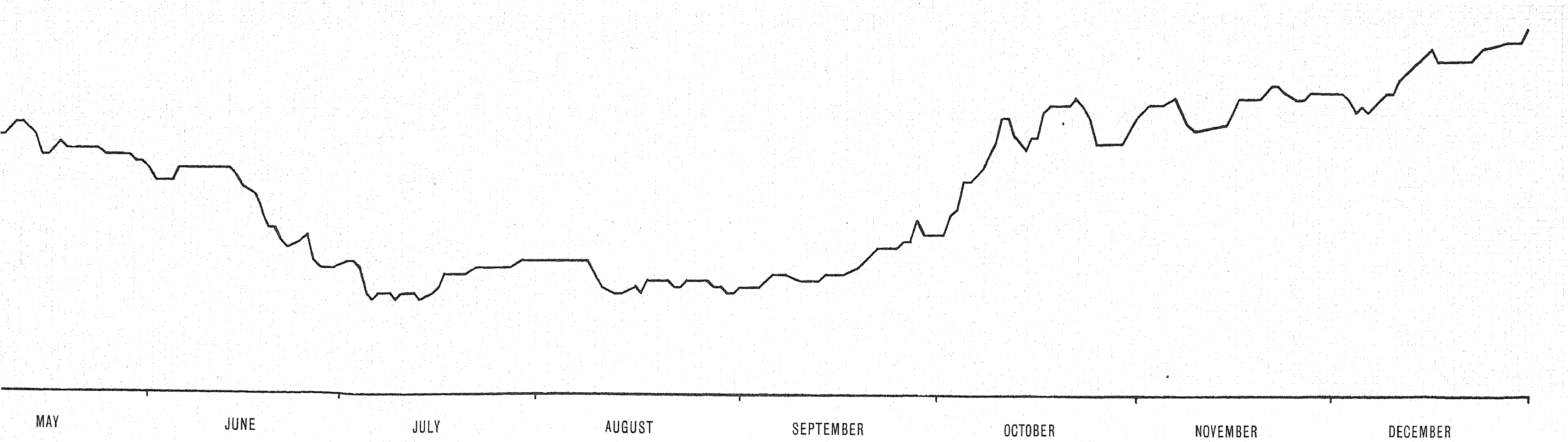
SINGAPORE DAILY MARKET PRICES 1935



COPRA "SUNDRIED"

SINGAPORE DAILY MARKET PRICES 1935

Supplement to
The Malayan Agricultural Journal, March 1936.



Palm Oil.—Prices quoted during February for the Malayan commodities are given in the following table.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1936.	Palm Oil in Bulk, c i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
Feb. 7	21. 0. 0	11. 0. 0
,, 14	21. 10. 0	11. 5. 0
,, 21	21. 0. 0	11. 2. 6

Copra.—Prices weakened throughout February, the month closing on a still falling market. The sun-dried grade opened in Singapore at $6.60 per picul, and fell to $5.15 at the close, the average for the month being $5.68 per picul as compared with $6.08 in January. The mixed quality fell in price also, averaging $5.16 per picul as compared with $5.51 in the previous month.

Copra cake fell to $1.25 per picul at the end of the month, the average price for February being $1.34 per picul as compared with $1.40 in January.

Rice.—The average wholesale prices of rice per picul in Singapore for January were as follows:—Siam No. 2 (ordinary) $3.64, Rangoon No. 1 $3.45, Saigon $3.37, as compared with December corresponding prices of $3.62, $3.57 and $3.32. The January 1935 respective prices were $3.11, $2.90 and $3.02.

The average retail market prices in cents per gantang of No. 2 Siam rice in January were:—Singapore 34, Penang 30, Malacca 26, as compared with 32, 30 and 27 respectively in December.

The average declared trade value of imports of rice in January was $3.64 per picul, as compared with $3.63 in December and $3.66 in November.

Padi.—The Government Rice Mill at Bagan Serai raised the price paid for padi from $1.65 to $1.75 per picul, but lowered it to $1.70 towards the end of the month. Retail prices per gantang ranged from 6 to 14 cents in different parts of the country.

Pineapples.—Prices in Singapore were maintained at the levels recently fixed by the Packers' Combine which are: Cubes $3.45 per case, Sliced Flat $3.25, Sliced Tall $3.35. The January average prices were $3.50, $3.30 and $3.44 respectively.

Prices of fresh fruit per 100 were: Selangor $1.20 to $4; Singapore $1.50 to $3.40; Johore, 1st quality $2 to $5, 2nd quality $1.50 to $3.50, 3rd quality 70 cents to $2.

Beverages.

Tea.—Seven consignments of Malayan tea were sold on the London market during February. One consignment of highland tea averaged 1s. 1d., and the remaining consignments of lowland tea were sold at prices averaging 1s. and 1s. 0¼d. per lb.

Average London prices per lb. during the month for tea consignments from other countries were as follows:—Ceylon 1s. 2.38d., Java 10.77d., Indian Northern 1s. 1.42d., Indian Southern 1s. 0.94d., Sumatra 10.66d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report*, 25th February, 1936, of the Colombo Brokers' Association, and are as follows (rupee cents per lb.):—High Grown Teas 95 cents, Medium Grown Teas 68 cents, Low Grown Teas 61 cents.

Coffee.—Sourabaya coffee opened at higher prices than the previous month, weakening in the second half of the month. Opening prices per picul were $14 to $15, falling to $13 to $14. Palembang coffee improved, the range of prices rising from $7 to $8 to $7.50 to $8.50 at the close.

Prices of locally-grown coffee were low, ranging from $11 to $28 per picul.

Spices.

Arecanuts.—Prices in Singapore fell during February. Average prices per picul were:—Splits $4.50 to $6.00; Sliced $7.50 to $8.50; Red Whole $5.06 to $6.12.

The Singapore Chamber of Commerce average prices per picul were:—Best $6.41, Medium $5.89, Mixed $4.82, as compared with $6.52, $6.07 and $4.99 respectively in January.

Pepper.—There is very little business passing, and prices are virtually nominal. They were marked down during February, and average prices per picul for the month were: Singapore Black $8.90, Singapore White $16.30, Muntok White $16.80, as compared with $9.06, $16.88 and $17.38 respectively in January.

Nutmegs.—There was a considerable drop in Singapore prices during February, the monthly averages per picul being: 110's $32 and 80's $32.80, as compared with $35.50 and $36 in January.

Mace.—Prices of this commodity also weakened, Siouw averaging $102 per picul, and Amboina $73, as compared with $105 and $74.50 in January.

Cloves.—Nominal Singapore prices continued unchanged at $37 per picul for both Zanzibar and Amboina.

Cardamoms.—According to the Ceylon Chamber of Commerce weekly reports green cardamoms were quoted during February at Rs. 1 to Rs. 1.22 rising to Rs. 1.15 to Rs. 1.25 at the close.

Miscellaneous.

Tuba Root (*Derris*).—There was a much firmer tone in the Singapore market during February, and, in consequence, prices advanced substantially. The average price of roots sold on rotenone content was $49 per picul, and for roots sold on a basis of ether extract was $31.50. The January average prices were $45 and $28 respectively.

Gambier.—Block remained unchanged at $6.50 per picul, while No. 1 Cube improved to $10.50 per picul as compared with $10 in January.

Tapioca.—There was no change in the Singapore market for this commodity, prices per picul being: Flake Fair $5.50, Seed Pearl $5.50, Medium Pearl $6.50.

Sago.—Prices in Singapore weakened slightly at the close of February, averages for the month being (per picul): Pearl, Small Fair $3.74, Flour, Sarawak Fair, $2.48, as compared with $3.75 and $2.50 in the previous month.

Tobacco.—Prices of locally grown tobacco were very high in Kelantan, being $80 and $50 per picul for 2nd and 3rd quality respectively. The range of prices in other parts of the country was as follows:—1st quality $25 to $68, ($80 in one District of Selangor), 2nd quality $20 to $45, 3rd quality $10 to $30.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross. London, S.W.1.

GENERAL RICE SUMMARY.*

January, 1936.

Malaya.—Imports of foreign rice during January were 49,935 tons, and exports 15,709 tons. Net imports were 34,226 tons as compared with 59,928 tons in 1935†.

Of the January imports, 49 per cent. were consigned to Singapore, 15 per cent. to Penang, 9 per cent. to Malacca, 24 per cent. to the Federated Malay States, and 3 per cent. to the Unfederated Malay States. Of the total, 76 per cent. came from Siam, 19 per cent. from Burma, 4 per cent. from French Indo-China, and 1 per cent. from other countries.

Of the exports during January 67 per cent. were consigned to the Netherlands Indies, and 33 per cent. to other countries. The various kinds of rice exported were (in tons, percentages are shewn in brackets): Siam 12,639 (80.5), Burma 2,168 (13.8), French Indo-China 727 (4.6), parboiled 62 (0.4), local production 113 (0.7).

India and Burma.—Foreign exports for the year 1935 totalled 1,637,000 tons, as compared with 1,383,000 in 1934, an increase of 18.4 per cent. Of the 1935 exports 3.7 per cent. were to the United Kingdom, 9.3 per cent. to the Continent of Europe, 26.4 per cent. to Ceylon, 31.2 per cent. to the Straits Settlements and the Far East, and 29.4 to other countries. The corresponding 1934 percentages were 8.2, 17.1, 26.5, 20.5 and 27.7.

Burma's total exports of rice and bran (*Bangkok Times,* 10th February, 1935) from 1st January to 28th December, 1935, were 3,356,717 metric tons, as compared with 3,787,538 metric tons in 1934, a decrease of 11.4 per cent.

Siam.—Exports of rice and rice products from Bangkok during December are provisionally given as 122,466 tons. The total for 1935 was 1,510,585 tons as compared with 1,916,782 tons in the previous year.

Japan.—The yield of the second Formosan crop of 1935 was 672,365 tons, an increase of 30,311 tons (4.7 per cent.) over the corresponding crop of 1934.

French Indo-China.—Entries of padi into Cholon during January were 140,671 metric tons as compared with 158,537 metric tons in 1934, a decrease of 11.3 per cent. Exports of rice were 60,174 as against 135,066 metric tons, a decrease of 55.4 per cent.

Netherlands Indies.—According to *The Netherlands Indies Economic Bulletin,* 1st February 1936, the area under padi harvested during the period January to November 1935 was 7,595,250 acres as compared with 9,013,030 acres in 1934.

Imports of rice into the Netherlands Indies during the same period amounted to 361,857 metric tons as compared with 220,856 metric tons in 1934, an increase of 63.8 per cent.

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* Abridged from the Rice Summary for January, 1936, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935.

Ceylon.—Imports during January were 53,617 tons as compared with 46,510 tons in 1935, an increase of 15.3 per cent.

Of these, 6.5 per cent. were from British India, 69.5 per cent. from Burma, nil from the Straits Settlements, and 24 per cent. from other countries. The corresponding percentages for 1934 were 11.1, 75, 1.6, and 12.3.

Europe and America.—Shipments to Europe from the East during 1935 totalled 827,236 tons, a decrease of 32.3 per cent. when compared with the 1934 total of 1,222,473 tons. Of the 1935 shipments 39.4 per cent. were from Burma, 2.9 per cent. from Japan, 50.5 per cent. from Saigon, 5.9 per cent. from Siam, and 1.3 per cent. from Bengal. The corresponding percentages for 1934 were 32.2, 3.8, 52.7, 9.6 and 1.7.

Shipments for Cuba, West Indies, and America from 1st January to 13th December totalled 268,378 tons, as compared with 198,196 tons in 1934, an increase of 35.4 per cent.

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 31ST JANUARY, 1936.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1934	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING (a)		AREA OF TAPPABLE RUBBER NEVER BEEN TAPPED		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,691	410	0.9	15,560	34.8	655	1.5	15,970	35.7
Malacca	123,793	1,367	1.1	31,221	25.2	3,419	2.8	32,588	26.3
Penang Island	2,593	—	—	469	18.1	254	9.8	469	18.1
Singapore Island	33,312	3,633	10.9	9,247	27.8	462	1.4	12,880	38.7
Total S.S. ...	204,389	5,410	2.7	56,497	27.6	4,790	2.3	61,907	30.3
FEDERATED MALAY STATES :—									
Perak	295,895	10,721	3.6	66,884	22.6	14,527	4.9	77,605	26.2
Selangor	345,100	11,490	3.3	71,063	20.6	15,477	4.5	82,553	23.9
Negri Sembilan	258,381	12,555	4.8	52,910	20.5	17,295	6.7	65,465	25.3
Pahang	75,912	8,974	11.8	27,230	35.9	16,803	22.1	36,204	47.7
Total F.M.S. ...	975,288	43,740	4.5	218,087	22.3	64,102	6.6	261,827	26.8
UNFEDERATED MALAY STATES :—									
Johore	417,633	17,121	4.1	77,018	18.4	59,799	14.3	94,139	22.5
Kedah	199,180	3,880	1.0	22,423	11.3	19,349	9.7	26,303	13.2
Kelantan	28,891	403	1.4	9,475	32.8	4,656	16.1	9,878	34.2
Trengganu (b)	4,643	Nil	Nil	15	0.3	179	3.9	15	0.3
Perlis (c)	1,206	Nil	Nil	719	59.6	64	5.3	719	59.6
Brunei	(d) 4,991	Nil	Nil	1,610	32.3	848	17.0	1,610	32.3
Total U.M.S. ...	656,544	21,404	3.3	111,260	16.9	84,895	12.9	132,664	20.2
TOTAL MALAYA ...	1,836,221	70,554	3.8	385,844	21.0	153,787	8.4	456,398	24.8

Notes :—(a) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(b) Registered Companies only.
(c) Rendered quarterly.
(d) Acreage of tappable rubber on 1st May, 1934.

MALAYA RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JANUARY, 1936, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January 1936		during the month		January 1936						
	Ports	Dealers	Estates of 100 acres and over	during the month	January 1936	during the month	January 1936	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January 1936
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :— Federated Malay States ...	...	5,337	13,187	10,210	10,210	7,044	7,044	Nil	Nil	Nil	Nil	12,294	3,954	12,294	3,954	...	7,894	11,630	6	6
Johore ...	...	1,632	4,222	4,111	4,111	3,876	3,876	Nil	28	Nil	28	1,929	5,801	1,929	5,801	...	2,384	3,755	...	...
Kedah ...	...	181	3,384	3,379	3,379	505	505	Nil	Nil	Nil	Nil	1,445	2,671	1,445	2,671	...	386	2,947	...	...
Perlis ...	...	7	17	13	13	41	41	Nil	Nil	Nil	Nil	Nil	35	Nil	35	...	25	18	...	...
Kelantan ...	...	212	339	268	268	676	676	Nil	Nil	Nil	Nil	179	620	179	620	...	425	271	...	...
Trengganu ...	...	55	50	167	167	84	84	Nil	Nil	Nil	Nil	Nil	251	Nil	251	...	55	50	...	...
Brunei	...	3	50	53	53	67	67	...	...	...	...	...	118	...	118	...	8	47	...	...
Total Malay States	...	7,427	21,249	18,201	18,201	12,293	12,293	Nil	28	Nil	28	15,847	13,450	15,847	13,450	...	11,177	18,713	6	6
S. SETTLEMENTS :- Malacca ...	...	1,308	1,406	1,113	1,113	754	754	Nil		Nil		2,600		2,600		...	2,331	1,147	...	...
Province Wellesley	...	1,691	610	460	460	242	242	Nil		Nil		8,215		8,215		...	1,357	499	...	...
Penang ...	2,250	5,925	9	18	18	41	41	2,544	12,387	2,544	12,387		Nil		Nil	2,246	6,138	11	...	...
Singapore ...	3,669	16,460	160	158	158	37	37	9,936		9,936		12,439		12,439		4,071	18,740	170	22	22
Labuan	...	39	Nil	Nil	Nil	12	12	102		102		Nil		Nil		...	13	Nil	...	...
Total Straits Settlements	5,919	25,423	2,185	1,749	1,749	1,086	1,086	12,582	12,387	12,582	12,387	23,254	Nil	23,254	Nil	6,317	28,579	1,827	22	22
TOTAL MALAYA	5,919	32,850	23,434	19,950	19,950	13,379	13,379	12,582	12,415	12,582	12,415	39,101	13,450	39,101	13,450	6,317	39,756	20,545	28	28

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	6,859	17,897	5,909	3,339	2,076	254
WET RUBBER	1,035	843	229	370	308	132
TOTAL ...	7,894	18,740	6,138	3,709	2,384	386

TABLE III
FOREIGN EXPORTS

PORTS	For month	January 1936
29	30	31
Singapore ...	22,255	22,255
Penang ...	11,237	11,237
Port Swettenham.	5,466	5,466
Malacca ...	143	143
MALAYA ...	39,101	39,101

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January 1936
32	33	34
Malay States ...	29,297	29,297
Straits Settlements	2,588	2,588
MALAYA ...	31,885	31,885

Notes :—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained
2. The production of estates of less than 100 acres is estimated from the formula ; Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i e.,* Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (35) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 25 February, 1936.

METEOROLOGICAL SUMMARY, MALAYA, JANUARY, 1936.

Locality.	Air Temperature in degrees Fahrenheit: Means of A. Max.	B. Min.	Mean of A and B.	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total		Most in a day. Amt.	Number of days: Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total.	Daily Mean.	Per cent.
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	88.6	71.9	80.3	93	70	84	73	83.2	84.0	5.77	146.6	2.03	20	17		5		123.10	3.97	33
Bukit Jeram, Selangor ...	86.6	71.9	79.3	90	69	81	74	82.0	84.4	10.34	262.6	4.00	19	12	1	1		160.10	5.16	43
Sitiawan, Perak ...	87.7	72.7	80.2	91	71	83	75	82.6	83.3	4.95	125.7	1.15	13	10	3			196.15	6.00	51
Temerloh, Pahang ...	84.2	71.8	78.0	89	70	78	73	82.0	83.9	8.45	214.6	1.79	19	15		2		109.30	3.53	30
Kuala Lipis, Pahang ...	84.4	70.6	77.5	91	68	76	73	81.1	82.4	14.44	366.8	3.26	25	19	1	12		119.20	3.85	32
Kuala Pahang, Pahang ...	82.0	73.5	77.7	86	71	77	78	79.3	81.6	25.75	654.1	6.14	24	23				117.85	3.80	32
Kallang Aerodrome, S'pore ...	85.2	74.5	79.9	89	72	77	77	80.3	81.9	6.22	158.0	1.32	19	14				133.30	4.30	35
Butterworth, Province Wellesley ...	86.5	72.8	79.7	89	70	79	75	83.9	84.8	7.40	188.0	1.93	14	10	1			210.35	6.79	57
Bayan Lepas Aerodrome, Penang ...	86.8	73.6	80.2	90	71	79	77	82.6	83.3	4.76	120.9	1.47	17	10	1			208.15	6.71	57
Bukit China, Malacca ...	85.0	73.0	79.0	90	71	79	75	81.0	82.2	3.07	78.0	0.97	12	8				153.15	4.94	41
Kluang, Johore ...	85.1	71.2	78.1	90	69	'73	73	79.9	81.0	5.94	150.9	1.96	15	12	1	6		122.95	3.97	33
Bukit Lalang, Mersing, Johore	81.8	72.3	77.1	85	70	77	75	78.6	79.4	21.80	553.7	6.31	22	20			2	132.55	4.27	35
Alor Star, Kedah ...	87.5	71.0	79.3	91	67	81	74	82.9	84.5	3.43	87.1	0.67	15	14	4	1		197.40	6.37	54
Kota Bahru, Kelantan ...	84.1	72.5	78.3	86	70	78	76	80.6	82.5	18.55	471.2	8.30	21	16		1	1	136.10	4.39	37
Kuala Trengganu, Trengganu	82.9	72.3	77.6	83	70	77	75	79.3	80.6	18.94	481.1	8.75	22	20			1	116.80	3.77	32
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	69.2	61.0	65.1	74	59	64	63	70.2	71.0	14.25	362.0	3.08	26	22		23		73.40	2.37	20
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	70.9	57.6	64.3	75	50	66	62	68.5	68.9	8.73	221.7	1.80	23	21				88.90	2.87	24
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	69.8	58.5	64.1	74	55	63	60			9.36	237.7	2.04	24	23				98.10	3.61	27

Compiled from Returns supplied by the Meteorological Branch, Malaya

NOTICE.

Department of Agriculture, S.S. and F.M.S.

The Director of Agriculture invites those interested in agriculture to visit the School of Agriculture, Serdang, the Experiment or Agricultural Stations on which miscellaneous crops are cultivated and the Stations and Plots devoted to experiments in padi growing.

Intending visitors to the School of Agriculture should communicate with the Vice Principal, School of Agriculture, Serdang, Selangor.

The School and the Central Experiment Station are situated at about 14 miles by road from Kuala Lumpur and 5½ miles from Sungei Besi Railway Station where cars are usually available for hire. "Visitors' Days" at the Plantation are on the first and third Wednesdays in each month: visitors are requested to arrive at 8.30 a.m. unless previous arrangements are made; limited accommodation is available in a hostel on the Plantation. All enquiries concerning visits should be addressed to the Senior Assistant Agriculturist, Central Experiment Station, Serdang.

Other Stations and Plots, together with the addresses of Officers to whom enquiries should be sent, are listed below:

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Coconut Experiment Station, Klang, *The Agriculturist, Department of Agriculture, Kuala Lumpur.*

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ERRATA

Special Bulletin General Series No. 22.

Report of the Field Branch for the year 1934.

page 140, line 20 for "foot and mouth disease" read "swine fever".

line 21 for "causing" read "caused".

THE

Malayan Agricultural Journal.

APRIL, 1936.

EDITORIAL.

Colonization of new Rice-Growing Areas

Information has been given, from time to time, in the pages of this Journal, on the development of new areas and the improvement of existing areas of rice land. These accounts have dealt mainly with the engineering problems involved and in the establishment of varieties of padi suitable for the local conditions. Little has been said regarding the equally important subject of colonization and administration. These aspects, however, have not been overlooked as it has been realized that neglect of them would nullify the time and money spent on development work. Land Officers have followed the development of schemes very closely, and have not only facilitated the progress of the work of the technical departments, but have taken early steps to organize the village life.

Included in this number is an account of the Sungei Manik Irrigation Scheme, by Mr. de Moubray, who, as District Officer, Lower Perak, is responsible for the administration involved. In addition to giving a brief account of the irrigation scheme, the author describes the methods which he has adopted as the scheme developed, in dealing with the colonization of the area. In the absence of pressure of population in most Malay districts it is no easy matter to induce the right type of Malay to move his habitation and to adapt himself to the different conditions of life which are inseparable with the development of newly-opened areas, but Mr. de Moubray is hopeful of success in this direction.

The measure of success which has already crowned Mr. de Moubray's efforts is encouraging, and the fact that he advances his plans with caution undoubtedly enables him to avoid the many unforseen pitfalls which might not only result in hardship to the settlers, but which would almost certainly prejudice the future development of the area.

The object of the development of new areas under padi must not be the mere transfer of the agricultural population from one part of the country to another, but, as the author states, to make available plots of land of a size sufficiently large to ensure an exportable surplus and a certain livelihood for the settlers. The encouraging results of the crops obtained at Sungei Manik lead to the conclusion that the object will be attained, and this irrigation scheme prove a real contribution towards rendering Malaya more independent of imports of rice to satisfy local demands.

Copra Kilns for Small Estates.

Many of the improved kilns of permanent construction originally recommended for use by small-holders have been erected and are being operated successfully in various parts of the country. These kilns were primarily designed for use by co-operative societies and large-scale producers and were not suitable for the individual small-holder who required a kiln of a size suitable only for his own crop. Thus the owner of a small area of coconuts has awaited the introduction of a small kiln which combines cheapness with efficiency.

A solution to this problem has now been found, and the article in this number, written by the Officer-in-Charge of Copra Investigations, is a contribution of great value to the industry. The two kilns which he here describes are designed to deal with a 10 acre and a 30 acre holding of coconuts. They both combine cheapness of construction with rapid drying. Necessarily cheapness will appeal to the small-holder, while rapid drying ensures a high-grade product without the attendant risk of interrupted drying (resulting in a bad product) which is always possible with slow drying. Whereas on the Ceylon type of kiln in general use, three to four days are required for drying, in the new design the drying operation is completed in 30 hours.

In view of the fact that many small-holders confine copra production to a few days in the month, employing the remaining days for other business, it is recommended that when possible the "30 acre" kiln should be used.

While these kilns are especially designed for small-holders they will be found of equal use under certain circumstances on the larger estates, in particular to cope with the crop from isolated areas, when the cost of transport of nuts to the central factory is prohibitive, and also for the treatment of nuts from young areas before the erection of a large kiln is justified by the crop.

The Agricultural Trade of Malaya.

One of the most encouraging features of the agricultural trade of Malaya in 1935, which forms the subject of an article in this number, is the marked increase in net exports. The figures indicate the steady development of estates during the past few years, a development not only of area planted, but in methods of cultivation resulting in greater efficiency and heavier crops.

The exports of oil palm products exhibit a natural expansion due to an increased area reaching the bearing stage. A steady increase may be expected for some years to come.

Copra and coconut oil production has exceeded expectations. The new record for high production may be due to favourable climatic conditions, to the fact that many new areas of coconut small holdings have come into bearing, and also to the increased attention given to water control.

In contrast to the former system of interplanting pineapples with rubber, two-thirds of the area under pineapples is now treated as a sole crop. This may well be a contributing factor for the increased production of canned pineapples.

Improved methods of cultivation now receiving consideration are likely to result in still greater crops in the future.

By reason of the low prices ruling in 1935, producers did not reap the full advantage of the increase of production. If indeed the world is now emerging from the acute trade depression, Malaya will find itself better equipped than hitherto to take advantage of the improved conditions, while the steady advance that has been made regarding quality will commend Malayan produce on the world markets.

Original Articles.

THE SUNGEI MANIK IRRIGATION SCHEME

BY

G. A. DE C. DE MOUBRAY,

Malayan Civil Service. District Officer, Lower Perak.

History.

The Sungei Manik Irrigation Scheme takes its name from the Sungei Manik, a tidal creek of the Perak River and a flood channel of the Batang Padang River.

Rice was first cultivated on the banks of the Sungei Manik in 1916. In 1922 and 1923 the part of the stream in the cultivated area was canalized, and this canalization was extended later towards the Batang Padang Mati, one of the network of overflow channels of the Batang Padang. The rice fields depended at first on rain water supplemented by floods and high tides banking up the Sungei Manik from the Perak River. In about 1928 a water gate was constructed for the purpose of trapping and retaining this water. A brushwood dam across the Batang Padang Mati was at one time used further to supplement the supply.

In 1931, when 1,249 acres had been alienated and about 800 acres cultivated, plans for the "First Stage" of the irrigation scheme were drawn up by the present Adviser on Drainage and Irrigation. Work started late in the following year, having been much delayed by the Retrenchment Commission. An intake was constructed on the Batang Padang Mati capable of commanding the First Stage. There was a further delay owing to uncertainty as to whether powers should be taken to compel land-owners to construct the minor distributary channels. In 1934 it was decided that they should be constructed by Government, and in October 1934 water was first supplied by their means.

Expediency was not the ground for this decision and it now seems most fortunate that distributaries are being constructed by the Government. The conversion of four or more acres of virgin jungle into rice-land is in itself a sufficient strain on settlers, and a drain on their financial resources, for while waiting for the burn they must earn enough to keep themselves in food. Furthermore, gaps would almost certainly have been left in constructional work which would have cut off the supply of irrigation water to fields further down the line. It is also most unlikely that the grading of distributaries would have been as satisfactory as it now is, the method of their construction being quite new to Malays, for they are built above the surrounding land, the bottom of the channel being at ground level.

General Characteristics.

The scheme is in many respects unique. Large parts of the area were at one time permanently many feet under water, the Batang Padang River overflowing its banks and the flood-water flowing off in a network of subsidiary streams. The

first necessity, therefore, was the dredging and bunding of the Batang Padang River. Controlled drainage and irrigation have had to come later except in and around the very restricted area already under cultivation. During the wetter months one can now walk along several miles of the Batang Padang bund with at least four feet of water on one side and dry ground on the other.

As a large-scale irrigation scheme it is also unique in that it is being carried out in dense virgin jungle. This virgin jungle is a source of the following three difficulties:—

(*a*) Obtaining full and accurate topographical information. For instance, in an area which was considered adequately explored, three old channels of the Batang Padang River have recently been discovered.

(*b*) The physical resistance this forest offers to effective development.

(*c*) The cost of maintenance—owing to rapid deterioration—of irrigation channels constructed ahead of agricultural development.

The scheme area occupies roughly 30,000 acres, of which probably 23,000 acres net will be available for padi fields. The topographical information possessed with regard to two-thirds of the area is still insufficiently complete for it to be possible to plan the whole area. This is one of the principal reasons why the unique course was adopted of constructing a major irrigation work in progressive stages starting with a temporary intake situated at the bottom end of the scheme area and capable of irrigating only a small fraction thereof. Other reasons were that the work was started in the depths of the slump; that only 800 acres were under cultivation in 1931; that this area was the furthest away from the future permanent intake; and, lastly, that the area is difficult of access.

Development in Progressive Stages.

In 1935 the Batang Padang Bund was completed. This bund prevents the Batang Padang River from overflowing into the scheme area; but it has also had the effect of cutting off the supply of water to the intake on the Batang Padang Mati. During the last irrigation season it has therefore been necessary to connect this old intake to a temporary intake on the main stream of the Batang Padang River by means of a short canal through the bund and a minor tributary of the Batang Padang Mati. At the time of writing the ends of this canal have already been sealed and the breach in the bund repaired, and a more permanent intake higher up the Batang Padang, with a canal system to feed the "Second Stage" (2,500 acres) and the "First Stage" intake (which will then be a control gate), is approaching completion. According to present proposals, the permanent barrage across the Batang Padang River will be started in 1938, ready for the 1939-1940 padi season.

Considerable ingenuity is being shewn in fitting these instalments of the scheme into the general scheme as it evolves. In many cases existing streams are being used first for the purpose of irrigation and later for that of drainage. This is the first large irrigation scheme in this country so designed that the final plans for

each stage shew complete and distinct systems of irrigation and drainage, permitting the drift of water across every rice field in the area, thus providing the best conditions for a good padi crop.

Colonization.

The following table shews the development of the colonization of the area.

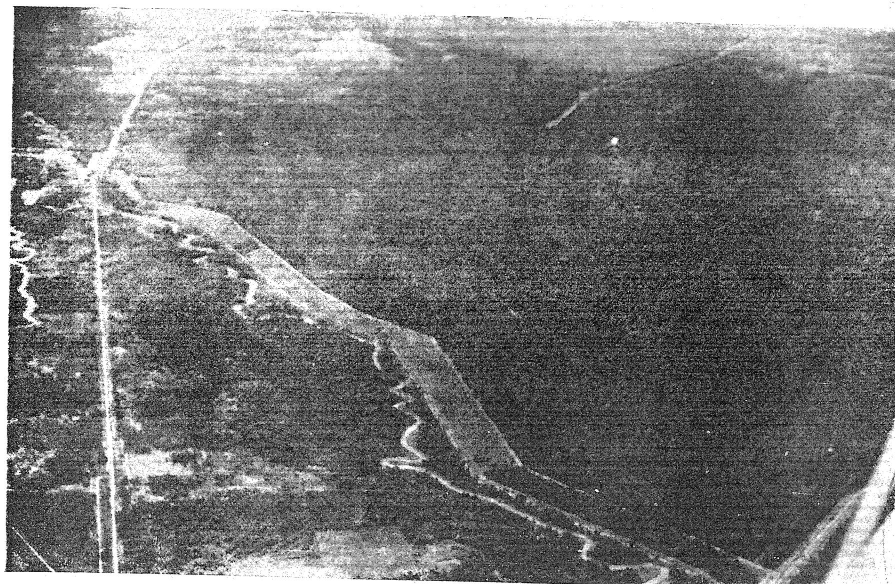
Year	Area Alienated		Area Planted	Area Abandoned	Area Alienated not yet Felled
	Each Year	Total			
Prior to 1932		1,249		50 ?	
1932		1,249	1,030	50 ?	169
1933	1,518	2,767	1,500	50 ?	1,217
1934	670	3,437	1,947	421	1,069
1935	971	4,007	2,820	421	414

The figures shew that there was a check in development in the 1933-34 season, the indications being the heavy drop in the area alienated in 1934 and the increase in the area abandoned. Local opinion agrees that the main cause was extensive damage in the newly alienated area by a herd of probably 24 elephants, which resulted in the abandonment of most of the land newly alienated and the complete disappearance of the registered owners. A subsidiary cause is believed to have been the difficulty of access to this new area. It is not thought that the competition of rising prices for other crops exercised any appreciable influence towards the abandonment, for up to that time the settlers had been drawn almost exclusively from among coconut planters, and the price of copra was then at its lowest point.

It will be seen that there has been an appreciable recovery in 1935 in the area alienated, in that planted, and in the area of unfelled jungle. By December 1935 fresh applications had been received, and were under consideration, for about 2,500 acres of land.

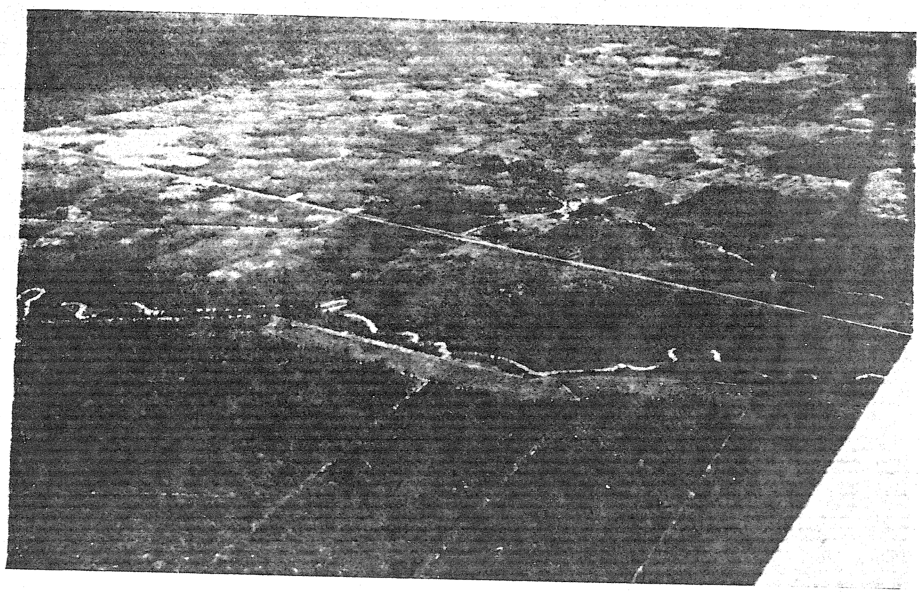
Elephant Control.

Attempts to control the movements of the elephants were inaugurated in 1934, but in April 1935 were admitted to be a failure. Orders were then given to drive the elephants across the Kinta or Perak Rivers, and, if they broke back, to shoot them. Fourteen elephants have now been shot and damage has, at least temporarily, ceased.



I. 21

By courtesy of the Drainage & Irrigation Dept.



S. 29

By courtesy of the Drainage & Irrigation Dept.

Improvement of Means of Communication.

Early this year a bridle path was made from the railway line two miles into the area by widening one of the bunds of a distributary. A $3\frac{1}{2}$ mile bridle path into the area from Teluk Anson was planned in 1935 and provision for its construction and for the acquisition of the necessary land was entered in the 1936 estimates. In the middle of October funds were found to be available for immediate acquisition. The Land Office was able to peg out and to complete the negotiations for acquiring a strip of land nearly three miles long through small holdings within the two months at its disposal. Construction is about to start. This bridle path will be unique in Malaya in incorporating an asphalted all-weather cycling track. An access road will eventually follow the line.

The construction of a bridle path into the area from Sungei Tukang Sidin Station was started in December 1935. Traces have been decided upon for bridle paths from the old Chikus Railway Halt and from Degong Railway Station. It was proposed to start work on these in January 1936. As an experiment, arrangements were made for trains to stop at the old Chikus Halt from January 1936.

It is expected that the most popular means of transport of padi will be by water to the mill at Teluk Anson, and with this in view it is proposed to improve the numerous rivers within, and bordering on the scheme area. A mill site and sites for buying agencies have been selected on these rivers.

Increasing Applications for Land.

The critical date for the Sungei Manik Scheme was that of the first harvest after irrigation, namely March 1935. For some time previously the scheme had been losing in popularity. Two factors, however, contributed to a change in attitude, (*a*) that it was obvious that something was being done about elephants, and (*b*) the satisfactory harvest. Test cuttings on five lots in the 1916 to 1931 alienations shewed an average yield of 468 gantangs an acre. This was probably higher than the true average, but the cultivators feel confident of even higher yields. It is probable that the decision that Government should construct the distributaries, and the mere fact of seeing water flowing in them, added to the effect.

Another aspect of the high yields is that there was an exportable surplus of padi. It is not known how great it was, but when the Sungei Manik control gate was closed in the middle of June there were immediate petitions from men who were still exporting padi.

Applications, which had decreased in number very considerably during the latter half of 1935, began to flow in again. Most of the applicants only intended entering into occupation in 1936, although many of them were induced to do so at an earlier date. They were, however, too late for the 1935 planting season. Their attempts to plant in 1935, as can be seen from the accompanying aerial photographs, resulted in a bad burn, due to the felled trees not being allowed sufficient time to dry before being burnt, and in patches of forest being left unfelled. Last moment applications for land were also responsible for a bad burn in 1934.

The appointment of a Colonization Officer, which was at one time fixed for 1936, was put forward to October 1935 in order to endeavour to advance the annual alienation season.

The colonization methods in the Punjab are largely being taken as a model. These methods include propaganda, severe selection among applicants, and the grouping, in the colony, of families who come from the same locality in daughter colonies.

Careful selection is more necessary now than in the earlier stages, as the accepted policy is to increase the size of holdings of rice land in order to ensure both a bigger exportable surplus of padi, and a more certain livelihood for the settlers.

The policy has now been adopted of not restricting alienation to standard lots, but of placing families into occupation of the largest area it is believed they can cope with. For this reason, late in 1934, the Perak Drainage and Irrigation Board adopted the policy of "post survey", that is, of placing settlers into occupation of land under temporary license according to their estimated capacity, and of surveying and issuing titles later, according to effective occupation. The first systematic alienation under temporary license in Sungei Manik is about to start, and much is hoped from it, particularly in connexion with experiments with Perak Malays.

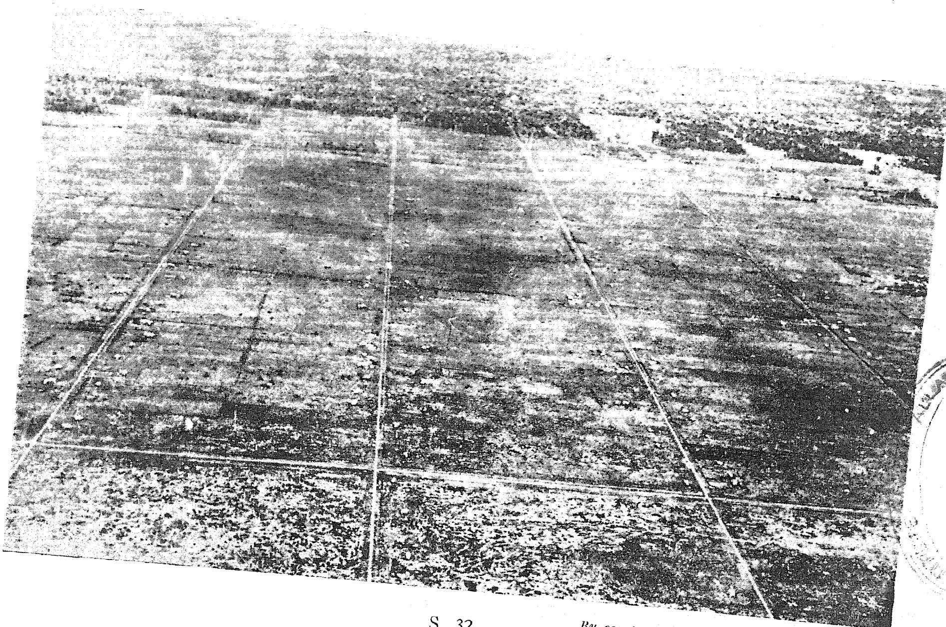
It is for the purpose primarily of carrying out this work that the Colonization Officer was appointed.

It has been ascertained that all land in the Panchang Bedena rice area in Selangor is "alienated" under temporary license, and that this allows of far more effective weeding out of undesirable colonists.

Propaganda and Recruiting.

The Colonization Officer started propaganda tours on the 15th November, 1935, with the enthusiastic help, in the Kuala Kangsar District, of the Datoh Stia. The results have been most instructive. There are definitely areas in which there is much keenness, other areas in which there is moderate interest, and again areas in which there is no interest at all. In those areas in which there is keenness there are marked indications of a land shortage or of very depressed economic conditions.

In December 1935, at a time of year when applications are usually low, there were 414 applications for approximately 2,500 acres (285 of the applications being from Perak Malays, 129 from foreign Malays). The Colonization Officer has been, however, under instructions to select with rigour, particularly in the case of Perak Malays. A large batch of Perak Malays from Bandar will probably only be considered in 1937, when I hope it will be possible to settle them in a part of the area still in their own mukim, about the last part of the area to be irrigated, and where controlled drainage will permit of an experiment which will



S. 32

By courtesy of the Drainage & Irrigation Dept.

do no great harm if it is unsuccessful. By March 1936, at the time of writing, colonists have been placed in occupation of just under 2,000 acres and felling has started.

Additional Sources of Income.

I am anxious to ensure that the settlers should not have to depend exclusively on padi.

In Krian a small air-breathing fish introduced from Siam (*Sepat Siam*), which breeds in profusion in the flooded rice fields and survives the dry season in pits, besides providing food, provides an additional source of cash income of about $10 per acre for the rice fields in which it is reared. Fry of this fish were introduced into Sungei Manik at the end of 1934, and a further consignment in 1935.

This fish has already provided food in plenty. It is most satisfactory to be able to record that when the water was drawn off the rice fields a Chinese dealer in Tapah Road established an agent at Sungei Manik and that there was a considerable trade in live fish.

The discovery (from the European point of view) has recently been made that Malayan carp can breed in ponds. The fish in question are kalui (*Osphromenus*), terbol (*Osteochilus*), tembakang (*Pristolepis*), and lampam (of which I do not know the scientific name). It is certain that there will be a ready market for kalui among Straits-born Chinese, as they are very similar to Chinese carp, with the advantage, however, of fewer bones, and it is very likely that the other varieties will also become popular. It is scarcely necessary to say that these fish are relished by Malays (I have found tembakang very appetising). The Officer-in-Charge, Fisheries Department, visited Sungei Manik recently at my request, and has selected a borrow pit which he proposes to stock with carp and to use as an experimental pond in order to ascertain whether these carp will breed under the special conditions of a rice-growing area. This pond will be under the charge of the Colonization Officer, who has previous experience in the breeding of Malayan carp. If the experiment is successful it will probably devolve on the Colonization Officer to organize Co-operative Societies to construct and maintain similar ponds.

It would seem necessary to explore the possibilities of Cottage Industries, particularly as a means of filling the time of rice cultivators during the off-season. Partly in order to make a start in this direction, I have arranged for the present rice cultivators to build a school and master's house in the middle of the rice area. The school has been opened and the Inspector of Schools has supplied a teacher specially selected for his work at crafts and cottage industries at the Sultan Idris Training College.

Regional Planning.

No dry land was provided for the earliest three-acre rice fields. In the next series of alienations half an acre in each four-acre lot was set apart for homesteads. Photograph S.32 shews the lines of houses arranged in these half-acre plots along distributaries. It was found, however, that these areas could not be kept sufficiently

dry for the cultivation of the more important fruit trees. The next step was to segregate the homestead areas entirely from rice-growing areas in the shape of ribbons. Photographs I.21 and S.29 shew such a ribbon between the Batang Padang bund and an irrigation channel. This is an area to be alienated this year. For the next stage, plans are being made for still more compact homestead areas. Village sites, firewood reserves, and through lines of communication are also being planned.

A padi experimental station has been started, and a site is now being selected for a fruit tree nursery for supplying the village areas with the highest quality of grafts. In the meantime, grafts will be supplied from other sources.

Administration.

The Drainage and Irrigation Engineer has recently been appointed Officer-in-Charge under the Irrigation Areas Enactment.

An Advisory Committee has yet more recently been appointed to co-ordinate the efforts of all officers stationed in Lower Perak directly interested in the scheme, to report on and to make recommendations concerning more important matters to the Perak Drainage and Irrigation Board, and, eventually, to exercise certain statutory powers.

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COPRA MANUFACTURE

BY

F. C. COOKE,

Officer-in-Charge of Copra Investigations.

Introduction.

This is the first of a series of three articles dealing with the preparation of copra in kilns in which the copra is heated directly by the hot gases of burning coconut shells. These kilns are known popularly as "smoke" driers though this name is a misnomer when applied to the improved type, capable of producing a superior grade of crisp, white copra. The term is more correctly applied to primitive kilns in which broken shell, husk, and often wood are used as fuel and from which a very inferior, heavily-smoked product is obtained*.

In the present article an account is given of two inexpensive kilns designed for use on small holdings of between 1 and 30 acres. In Part II details will be given of kilns of intermediate size suitable for trader-manufacturers and also for use on very small coconut estates and in areas of immature coconuts on large estates. In Part III an account will be given of recent investigations regarding the design and operation of large smoke kilns as used on European estates.

In order to distinguish the various kilns, a special nomenclature has been adopted and they are designated variously as "10 acre", "30 acre", "50 acre", "100 acre", 150 acre", "250 acre", "500 acre" and "750 acre" kilns. Such descriptive names are intended to indicate approximately the maximum acreage of mature coconuts each kiln is designed to serve, if allowance is made for crop fluctuations, kiln repairs, holidays and other factors.

Until recently a somewhat expensive kiln of intermediate size and of permanent construction has been recommended for use either by Malay trader-manufacturers who purchase nuts from the owners of small properties, or by co-operative societies composed of coconut small-holders. Although 33 kilns of this approved pattern have been built in various part of the country there are signs that progress in this direction is definitely limited, owing to the fact that the large army of small-property owners who have enthusiastically taken up the production of copra, following the advice of officers of the Department of Agriculture, have generally preferred to work individually rather than co-operatively.

As a result, innumerable kilns of crude, impermanent and unsatisfactory design have also been built in recent years as every small-holder could not afford to build an expensive approved kiln for his own use. As a natural corollary also, Chinese methods of production have been followed and a discoloured under-dried product has generally been obtained. It is to meet the requirements of such people that the "10 acre" and "30 acre" kilns have been devised.

* The Coconut Industry of the Philippine Islands by F. C. Cooke, Bulletin No. 23 of the Department of Agriculture, S.S. & F.M.S., pages 34 to 42. Also *Malayan Agricultural Journal* Vol. XXIV No. 3, page 135. H. T. Pagden.

An additional complication which has recently become apparent is that, in certain Malay reserves, copra making must necessarily be restricted to a few days in every month since the peasant has numerous other occupations such as *attap*-making, fishing, rubber tapping, rice growing, vegetable cultivation and general labour, from which he obtains important additional sources of income. Consequently, since his kiln cannot be in regular use, it must be of larger capacity than the size of his holding apparently justifies. Thus, for 5 acres of coconuts a "10 acre" kiln is inadequate, and a "30 acre" kiln must be recommended; the "10 acre" kiln in similar circumstances is suitable for small holdings of 2 or 3 acres.

PART I.

SMALL COPRA KILNS.

The "10 Acre" Kiln.

This miniature kiln, which is designed for use on small-holdings varying in size between 1 and 10 acres, is able to dry 100 coconuts and yield crisp, white, undistorted and uniformly dried copra in 15 hours.

It may be recalled that, at one time, considerable stress was laid on the belief, emanating from Ceylon, that copra must be dried slowly, and that a minimum of three days and preferably four days must be occupied in driving off the moisture if a satisfactory product is to be obtained*.

It is still quite correct that drying on the Ceylon type of smoke kiln cannot be forced unduly as, owing to the large pit, local concentrations of heat occur and drying is by no means uniform. If drying is accelerated by the use of additional fires, the hot zones will become more pronounced and some of the copra will be scorched, case-hardened and distorted, while the remainder will remain under-dried.

Recent investigations have shown that in such kilns only a certain quantity of the copra on the platform is being heated at a time, and that, if all the copra could be continuously and uniformly heated, a dry product could be obtained four or five times as quickly.

In this new small kiln high speed production can be effected with safety, and, furthermore, since the whole of the copra is continuously hot, there is no danger of spoilage through the chilling which may occur in larger kilns under wet-weather conditions of production. The principal problem on this smaller kiln has been to reduce the heat sufficiently and satisfactorily for such a small number of nuts, since at first it was found that the copra was either scorched through general overheating or oversmoked through restricting the combustion of the shell fuel in order to reduce the heat. The details given below must be carefully followed if satisfactory results are to be obtained.

General Arrangement.—High ground is selected for the site of the kiln which is a rectangular wooden chamber 6 feet high, the base being 3 feet square and the top open. A tunnel leads into the base of this chamber and forms the

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* Coconuts and Coconut Products, by F. C. Cooke—Bulletin No. 8, Department of Agriculture, S.S. & F.M.S., page 28.

THE "10 ACRE" KILN.

hearth in which a single chain of coconut shells is burnt continuously. The overall area covered by the chamber and tunnel is 7 feet x 3 feet; this is sheltered by an *attap* roof.

The Chamber.—The copra is dried on a platform of spaced nibong slats, covered with chicken wire, and arranged horizontally within the chamber, 5 feet above ground level. Some 3 inches beneath this platform there is a heat-spreader consisting of a piece of perforated sheet iron, 2 feet 9 inches square, which is supported horizontally by wire. This piece of iron is perforated with 36 holes, each 2 inches square and arranged at 5 inch centres.

The base of the chamber is filled to a height of 18 inches with rammed clay leaving a hole in the centre 1 foot square which is lined with loose bricks, and through which the hot gases emerge from the tunnel.

A drop shutter is provided at the top of the chamber so that the copra may be easily inserted or removed and the heat-spreader may be cleaned when necessary. There is also an inspection door 18 inches above ground level for cleaning the clay base of the chamber.

The Fire Tunnel.—This consists of two walls of loose bricks laid along the ground and leading into the base of the chamber. These rows are each 6 bricks high, are laid 1 foot apart, and are covered by a stout sheet of iron, 6 feet long and 18 inches wide, anchored in position by bricks, laid along the edges, and by rammed clay where it joins the base of the kiln. The bottom line of bricks is spaced so as to allow air to filter to the fire.

Operation.—Good copra can only be obtained if the copra grill is loaded with freshly split nuts. If the nuts are split in the field, heat must be applied within six hours or else deterioration sets in.

Clean dry coconut shells of even size are inter-locked and laid loosely in a single line on a sheet iron tray, 5 feet long and 8 inches wide, outside the kiln. The hollow end of the row is lit using scrap rubber or kerosene to assist combustion. When the shells are well alight and burning without smoke, the tray is slid as far as it will go into the tunnel, the burning end entering first. Thus the shells burn from the centre outwards against the incoming current of air. This keeps the flame small and reduces the rate of combustion.* If the shells are burnt in the opposite direction, the draught would cause them all to ignite simultaneously so spoiling the copra and possibly also destroying the kiln. It should be noted that if the tunnel is too small in cross section, the induced draught is so great that the fires burn with difficulty and give a smoky flame.

When the fire is nearly out and is beginning to smoke, the tray is withdrawn and reloaded with a fresh supply of shell fuel, and just before this second fire is finished, the copra is turned over. Subsequently three further fires are lit in succession until the copra is dry and ready for shelling.

Efficiency.—A single line of shell, five feet long, is made up of about 40 pieces of shell (halves) and lasts about 3 hours. A total of 200 pieces is thus used, so that all the shells obtained from one lot of copra are consumed in the subsequent

* This method of burning shell fuel was first used in this country by Mr. D. Graham of Teluk Anson.

run. It follows that, with such rapid drying, the heat efficiency of the kiln tends to be low but this does not matter so long as sufficient fuel is produced to meet the requirements of firing.

The drying time is remarkably short and although, when in operation, the fires need fairly frequent attention, intervals may safely be left between fires, when the copra is nearly dry, without deterioration occurring. Once a supply of dry shell fuel is available and the kiln and ground have dried out, copra of estate quality should be obtainable, irrespective of weather conditions.

Life and Capital.—Properly operated there is little fire risk and, if the poles and woodwork are initially and periodically treated with creosote, a 'life' of over 2 years may safely be anticipated, the *attaps* being renewed yearly.

In a year of 150 working days the "10 acre" kiln, costing the small-holder less than $10 to build will produce 60 piculs of copra; thus the capital cost of the kiln spread over two years is equivalent to 8 cents per picul, or $1 per acre for a 10 acre holding yielding 6 piculs of copra per acre.

When the use of the kiln is shared between two or more small-holders the rent payable to the owner of the kiln should not be less than the rate shewn above.

The "10 Acre" Kiln.

(100 nuts dried in 15 hours)

Cost of Materials and Labour.

Amount.	Materials.	Size.	Approx. Cost. $
100	Bricks	...	1.40
12	Jelutong planks	16 ft. x 7 in. x ½ in. ...	2.40
1 piece	Iron sheet	5 ft. x 1 ft. 6 in x 1/32 in. ...	1.20
2 pieces	Galvanized iron, flat.	One 5 ft. x 1 in.; One 2 ft. 9 in. x 2 ft. 9 in.	1.00
	Nibong Slats	...	0.10
3	Broties	16 ft. x 2 in x 2 in. ...	0.66
50	*Attaps*	6 ft. ...	0.50
4	Poles	8 ft. ...	0.36
	Creosote	...	0.20
4	Hinges	4 in. ...	0.20
1 bundle	Rotan fibre	...	0.10
1 kati	Nails	Various ...	0.08
		Cost of materials ...	8.20
		Transport of materials (say) ...	1.00
		Labour, one day ...	0.80
		Total ...	$10.00

Notes on Materials.

Item.	Required for:-	Remarks.
Bricks	The sides of the fire tunnel	Old bricks quite suitable
Planks	The sides of the chamber	New planks must be sun-dried before use. Thicker planks may be used.
Iron sheet	The top of the fire tunnel	A thick sheet is essential.
Galvanized iron	(1) Tray for shells (2) Heat-spreader	Old sheeting quite suitable.
Nibong slats	Copra platform	" " The spaced slats may be covered with fine chicken wire, 3 ft. x 3 ft.
Broties	To support the planks	Jungle poles may be used instead.
Attaps	The roof	Lay close and tie securely.
Poles	The roof	
Hinges	The copra door and inspection hole.	

The "30 acre" Kiln.

Recent investigations have shown that when a shell fire is burning in the firepit of a Ceylon kiln, the hot air does not spread out under the copra and heat the whole of the material more or less uniformly. Instead, the currents of hot air pass almost straight up from the fire through the copra, such movement being confined within a narrow inverted cone having the fire point for its apex.

With a fire pit 6 feet deep, the effective hot zone in a bed of copra is a circle about 4 feet in diameter immediately over each fire and, outside this zone, the copra may still be warm if the fire has already passed, or cold if it is has not. Actually it has been found that, in the cold zones, air passes down through the copra to the fires. Thus, in a Ceylon kiln, possibly only a quarter of the copra is being heated at any particular instant so it will be readily understood why in this type of kiln, drying is so slow. Theoretically, therefore, by trebling the number of fire points it should be possible to obtain dry copra in 24 hours instead of the minimum of three days normally required. If this were done, however, the kiln would be liable to destruction by fire owing to local concentration of heat in the large fire pit.

Conversely, it should be possible to isolate over a single short chain fire a very small section of kiln, 6 feet long by 4 feet wide, so that the small quantity of copra on the platform is continuously heated and drying is thereby accelerated without the fire risk which is attendant on the use of an increased number of fires in a full-sized kiln. In effect, while such a miniature kiln would represent the fiftieth part of a Ceylon kiln in size it would actually be able to handle about one-twentieth the quantity of copra owing to the accelerated drying.

Description of the "30 acre" kiln.

General Arrangement.—The "30 acre" kiln is a closed *attap*-roofed, plank building 12 feet high covering an area 10 feet by 5 feet. The copra platform is 6 feet long and 4 feet wide, arranged 6 feet above ground level. The firepit below is made 4 feet longer than the copra platform by means of two extensions so as to permit of a long chain of shells being used, thereby reducing the frequency with which the fires require renewal. High ground should be selected for the site of the kiln.

The Fire Pit.—This is a closed chamber of weather-boarded planking with two small doors, one at each end of the long side of the kiln. This allows the fireman to lay fresh shells at one end of the kiln while a fire is still burning at the other.

The planks for the walls should be well dried before use. No special ventilation need be provided since the air necessary for combustion will filter in between the boards; there should, however, be no large holes through which strong gusts of wind may enter, as the fires would be disturbed and the efficiency of the kiln would be impaired.

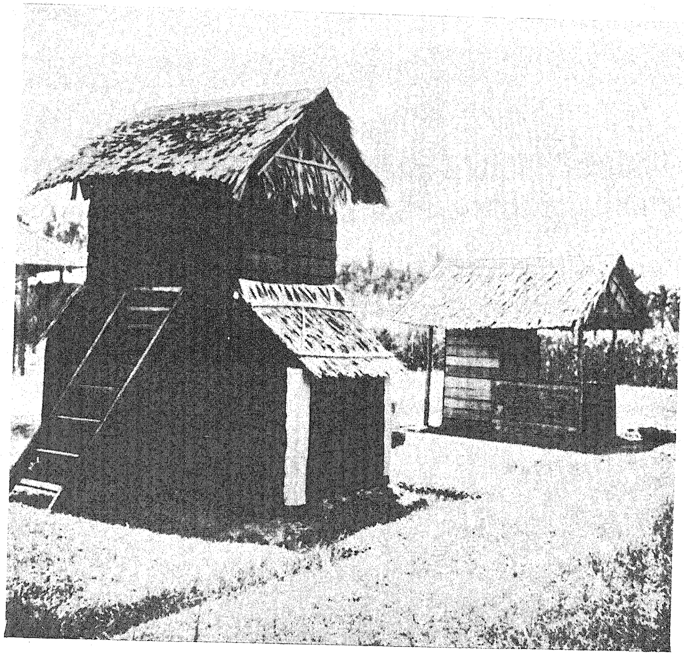
The Copra Platform.—This is a large box closed on four sides with weather-boarding; the top is open, and the bottom consists of a grill of spaced nibong slats or expanded metal overlaid with close mesh chicken wire. There is a pair of double doors on one side through which the split coconuts are inserted and the dry copra is removed.

The Roof.—The open top of the kiln is covered with an *attap* roof overhanging 9 inches all round, leaving a gap at the eaves of 9 inches to permit humid air to escape from the kiln.

The two sloping roofs of the extensions of the firepit consist of flattened galvanized iron which is covered with *attap* in order to reduce the loss of heat by radiation. This *attap* should not be laid closely on the zinc or it will crumble away through heat.

Operation.—The split coconuts are thrown on the grill without any special arrangement, though the top nuts are all turned face downwards. A chain of coconut shells 8 feet long is laid between two parallel lines of loose serrated brick-work. The shells used should be clean, dry and of even size, and should not be packed too tightly. The fire channel should be carefully covered with sacking whenever copra is being removed or split nuts are inserted. This is to catch husk and broken pieces of coconut meat which produce smoke.

A double line of shells is used for the first fire irrespective of whether the copra has been sun-dried or not; subsequently, single lines of shells are used successively, the copra being turned over after the second fire is out. In order to prevent the smoking which normally occurs when shell fires are first started, a few shells are ignited outside the kiln on a sheet-iron tray and, when ready, this tray is brought in and placed at the start of the line of shells.



Copra Kilns.

(*Left*) The "30 acre" Kiln. (*Right*) The "10 acre" Kiln.

Once a line of shells has been lit, it has been found that the fire requires no further attention as, owing to the heat reflected from the hot brickwork, the shells are pre-heated and dried before the fire reaches them. Thus a strong smokeless flame is assured and the fire progresses along the line steadily and uninterruptedly to its finish.

As a result, the attendant, after arranging and lighting a fire, may attend to other work; he may also safely retire to bed leaving a fire burning.

Efficiency.—A double line of shells about 8 feet long is made up of about 150 pieces of shell (halves) and lasts about 3½ hours. A single line of shells consists of about 70 pieces of shell and lasts 4 hours.

If the copra has not been sundried a total of about 500 pieces of half shell are required to dry 300 nuts. If the copra has been sundried before kiln-drying, one fire must be omitted and thus only 430 pieces of half-shell are used. Thus a surplus of shell is obtained with this kiln which is not the case with the "10 acre" kiln.

The kiln can, of course, be used to dry as little as 250 nuts, in which case the whole of the shells obtained from one charge are used for firing the next charge. Conversely, the heat efficiency is further improved if 400 nuts are dried but the copra obtained is rather more smoked and may also be scorched.

It is reported that a kiln of this type with a grill 8 feet long and 4 feet wide has been employed successfully to deal with lots of 600 nuts each, obtained from 90 acres of immature coconuts—an isolated area of a large coconut estate.

The drying time is very short and if the split nuts have been sundried effectively before insertion, dry copra can be removed in 24 hours. Allowing for intervals between the fires and for a full night's rest for the attendant, dry copra, without previous sundrying, can be obtained in 30 hours overall time.

It must be noted that the fires may not burn too well during the opening two runs when the kiln is cold and damp and that, as a result, the copra will take somewhat longer to dry and be somewhat smoky. Subsequently, when drier shells are available and the kiln and ground have dried out, copra of superior quality is obtainable in the time stated.

Life and Capital Cost.—In spite of the combustible nature of the materials of construction, it has been found that the fire risk is negligible. The original demonstration kiln has now been in regular operation in an exposed position for four months including a stormy period when superior copra was obtained without any change in procedure.

If the woodwork is carefully treated with creosote a 'life' of 2 years may safely be anticipated.

In a working year such a kiln will produce about 200 piculs of copra. If a small-holder owning 30 acres of coconuts does his own work and uses jungle materials wherever possible, he should be able to build the kiln for $15 and, therefore, the capital cost of the kiln spread over two years is equivalent only to 4 cents per picul or 50 cents per acre. Thus the rent for the use of such a kiln by a neighbour would be half that chargeable for the "10 acre" kiln.

"30 Acre" Kiln.

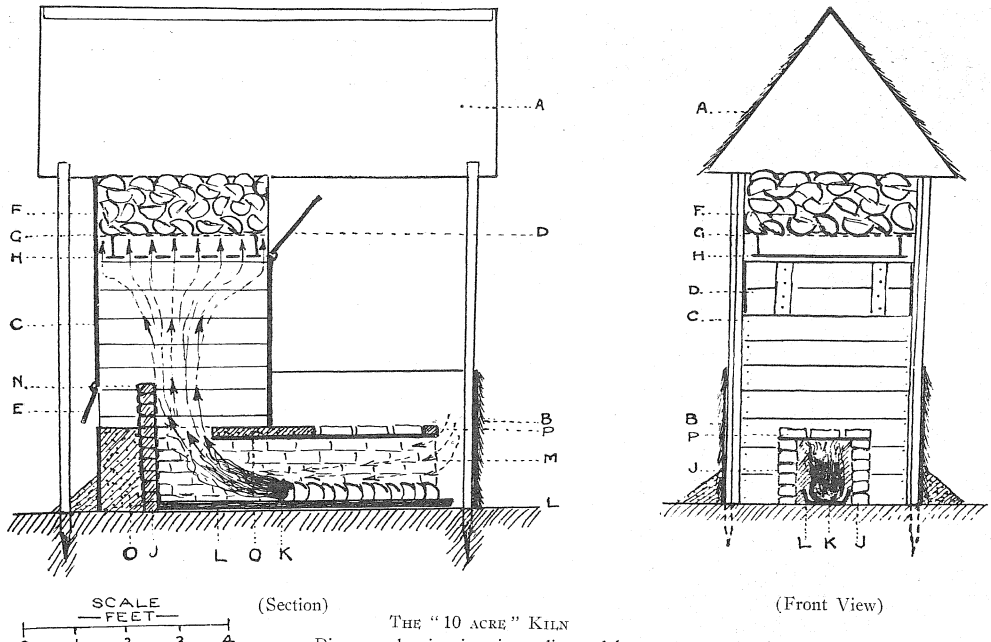
(300 nuts dried in 27 hours)

Cost of Materials and Labour.

Amount.	Materials.	Size.	Approx. Cost. $
28	Meranti planks	16 ft. x 7 in. x 5/8 in. ...	7.00
2 sheets	Galvanized iron flat	3 ft. 6 in. x 3 ft. ...	1.00
6	Bakau posts	16 ft. x 5 in. diameter ...	1.92
7	Broties	16 ft. x 3 in. x 2 in. ...	1.82
8	Poles	Light ...	0.64
60	Bricks	...	0.85
50	*Attaps*	6 ft. ...	0.50
1 gallon	Creosote	...	0.50
8	Hinges	...	0.40
	Nibong Slats	...	0.30
	Wire netting	6 ft. 6 in. x 3 ft. 6 in.; ½ in. mesh	0.40
1 bundle	Rotan fibre	...	0.10
1 kati	Nails	Various ...	0.07
		Cost of Materials ...	15.50
		Transport of materials (say) ...	1.30
		Carpenter 4 days ...	3.20
		Total ...	20.00

Notes on Material.

Item.	Required for:—	Remarks.
Planks	The walls of the kiln	New planks must be sun-dried before use.
Sheet iron	The tops of the wings	Old sheeting quite suitable.
Posts Broties	The framework of the kiln	Jungle timber may be used
Poles	To support the roof	
Bricks	The hearth	Old bricks quite suitable.
Attaps	Main and wing roofs	Lay close and tie securely.
Creosote	All timber	Posts should be treated before planting.
Hinges	For main and firepit doors	
Nibong	The copra platform	
Netting	To cover the slats.	

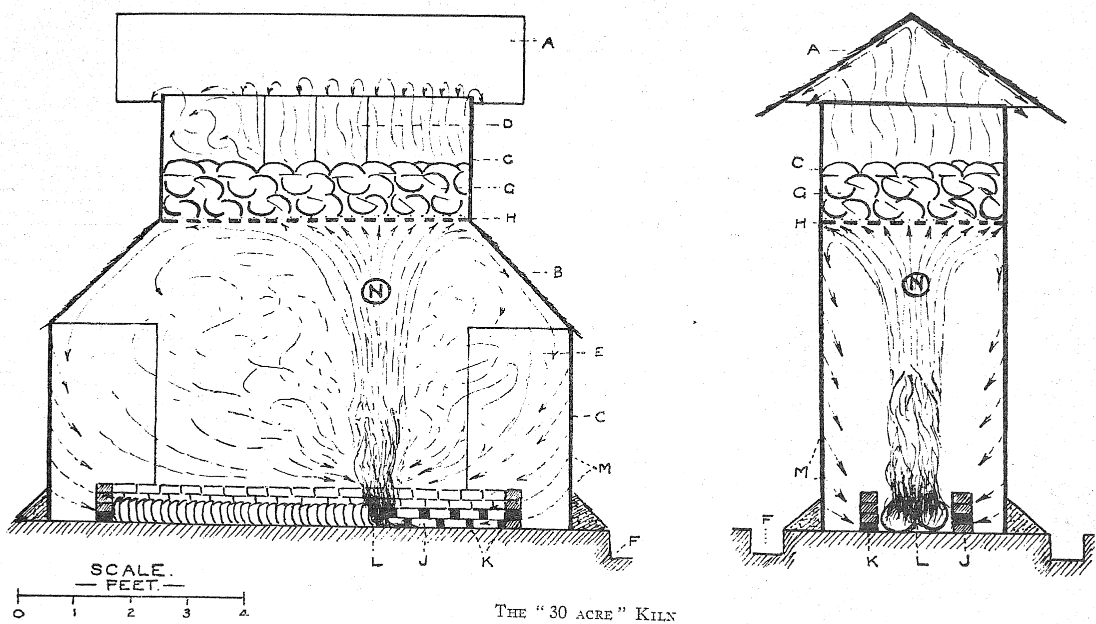


(Section) (Front View)

THE "10 ACRE" KILN

Diagram shewing imaginary lines of heat.

A. Attap Rooflet.
B. Attap or Sheet Iron Screens.
C. Plank Walls.
D. Charging Door.
E. Inspection Door.
F. Copra.
G. Copra Grill (3 ft. x 3 ft.).
H. Heat Spreader.
J. Wall of loose bricks.
K. Shell Fire.
L. Iron Tray.
M. Air Supply.
N. Bricks to divert heat vertically.
O. Rammed Clay.
P. Loose Bricks.



THE "30 ACRE" KILN

Sectional diagrams shewing the lines of heat as traced by fumes of ammonium chloride.

A. Attap Main Roof.
B. Attap-on-iron Wing Roof.
C. Plank Walls.
D. Double Doors for Copra.
E. Fire pit Doors.
F. Gutter round Kiln.
G. Copra.
H. Copra Grill.
J. Wall of loose bricks.
K. Gaps in brick work.
L. Travelling Shell Fire.
M. Cold Air Supply.
N. Travelling Cone of Heat.

Working Time Tables for Small Kilns.

	"10 Acre" Kiln.	Fires Used.
7 a.m.	Light fire	40 pieces
10 a.m.	Fire out Light fire	40 pieces
1 p.m.	Fire out Light fire	40 pieces
4 p.m.	Fire out Light fire	40 pieces
7 p.m.	Fire out Light fire and retire for night	40 pieces
10 p.m.	Fire out	
6 a.m.	Remove copra and recharge kiln.	

	"30 Acre" Kiln.	Fires Used.
8 a.m.	Light fire	150 pieces
11.30 12 noon	Fire out Light fire	70 pieces
4 p.m. 4.30	Light fire Turn copra and light fire	70 pieces
8.30 9 p.m.	Fire out Light fire and retire for night	70 pieces
1 p.m. 6 a.m.	Fire out Light fire	70 pieces
10 a.m. 10.30	Fire out Light fire	
	Extinguish fire when copra is dry	

Fires.

Double Row of Shells:—

Single Row of Shells:—

Comparative Performances of the Small Kilns.

Summary.	"10 acre" Kiln.	"30 acre" Kiln.
Number of nuts dried	100	300
Number of half shells used	200	500
Net firing time	15 hours.	23 hours.
Overall time	24 hours.	30 hours.

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MALAYAN AGRICULTURAL TRADE IN 1935

BY

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In a previous number of this Journal* an attempt was made to survey the agricultural trade of Malaya during the year 1934, and to contrast it with that of previous years. The method adopted is again employed in the present attempt to assess the extent and value of trade in 1935.

Consideration is given only to products which theoretically—although perhaps not economically—might be produced in Malaya. A consideration of the Malayan agricultural trade confined to such crops, and including livestock, meat and dairy produce, serves, therefore, the double purpose of providing an index figure of total local consumption and of shewing the scope which exists for local agricultural development.

Malayan agricultural trade will be considered under the following four headings:— the preparation for market and export of agricultural products grown within its borders (Export Crops); the import of agricultural products for local consumption (Import Products); the import of agricultural produce from surrounding countries, its re-conditioning, blending, grading as a preliminary to re-export (Entrepôt Trade); and lastly, the cultivation and marketing of Malayan crops for local consumption (Local Agricultural Produce).

Export Crops.

The principal export crops are rubber, coconuts, pineapples, oil palm, tapioca, sago and arecanuts. Gambier, once an important export crop, continues to decline, whereas tea and derris root (tuba) demand increasing attention.

Rubber.—In quantity and value, the production of rubber overshadows other local crops, which is not surprising when it is remembered that the area under rubber (3,282,000 acres) is almost twice as great as the total area under all other crops combined (1,706,000 acres). The control of production and exports exercised under the International Rubber Regulation Scheme was responsible for a decrease in output of rubber. The net exports were 416,000 tons, valued at $191,128,000, as compared with 466,000 tons, valued at $207,870,000 in 1934. It is estimated that of the total area of tappable rubber 20 per cent. was untapped throughout the year.

The average Singapore price of rubber in 1935 was 20.25 cents per lb., as compared with 20.63 cents in 1934, 10.21 cents in 1933 and 6.97 cents in 1932. The reduced production under the restriction scheme enabled the price to be maintained at the 1934 level, while total value of exports declined in value by $16,742,000.

Apart from rubber, the increase of production of crops for export was most marked. The total export of such products amounted to 314,500 tons, valued at $40,000,000, an increase over the previous year of 15.3 per cent. in quantity and of 71 per cent. in value. (See columns (4) and (5) in Table 3).

* *Malayan Agricultural Journal,* Vol. XXIII, No. 4, 1935.

The following figures of imports and exports embrace the principal agricultural products of Malaya.

Table I.
Imports and Exports of certain Agricultural Products 1935.

Product	Imports		Exports		Net Exports	
	Tons	Value $	Tons	Value $	Tons	Value $
Rubber ...	174,652	67,966,325	590,319	259,094,030	415,667	191,127,705
Coconut Products ...	106,061	7,409,458	261,314	22,016,324	155,253	14,606,866
Pineapples ...	—	162	73,923	8,330,902	73,923	8,330,740
Oil Palm Products	152	22,554	28,642	3,544,588	28,490	3,522,034
Arecanuts ...	41,900	3,761,031	64,785	6,702,314	22,885	2,941,283
Tapioca ...	5,845	507,161	24,256	2,157,032	18,411	1,649,871
Sago ...	61,775	2,333,139	69,616	3,432,700	7,841	1,099,561
Gambier ...	1,631	290,452	4,468	781,536	2,837	491,084
Derris ...	220	61,555	787	527,623	567	466,068

Coconut Products.—The production of coconut products reached a record high figure in 1935 as may be seen in the following table.

Table II.
Net Exports of Coconut Products.

Year	Fresh Coconuts		Copra		Coconut Oil		Total	
	Tons	Value $	Tons	Value $	Tons	Value $	Tons*	Value $
Av. 1923-1931	12,244	440,490	96,696	17,616,619	8,508	2,597,592	115,219	20,654,701
1932	7,824	316,166	97,277	10,755,596	11,949	1,985,726	118,886	13,057,488
1933	7,407	215,539	110,298	8,989,098	17,582	2,371,214	140,939	11,575,851
1934	7,201	190,192	95,599	5,864,692	25,484	2,322,358	139,028	8,377,242
1935	7,590	242,469	111,752	9,519,726	35,911	4,844,671	172,212	14,606,866

* In terms of copra equivalent.

Table III.

Annual Net Imports and Exports of Agricultural Products, Malaya

Year	Net Imports*		Net Exports† (excluding rubber)		Excess of Imports over Exports (excluding rubber)		Net Exports of Rubber		Excess of Total Imports over Exports	Excess Value of Exports over Value of Imports
	Quantity Tons	Value $	Quantity Tons	Value $	Quantity Tons	Value $	Quantity Tons	Value $	Quantity Tons	Value $
1	2	3	4	5	6	7	8	9	10	11
1923	643,000	101,600,000	206,600	43,100,000	436,400	58,500,000	181,700	227,200,000	254,700	168,700,000
1924	694,600	118,400,000	219,000	51,600,000	475,600	66,800,000	152,500	189,900,000	323,100	123,100,000
1925	744,800	133,100,000	218,700	48,600,000	526,100	84,500,000	161,800	519,000,000	364,300	434,500,000
1926	857,300	157,400,000	225,800	50,000,000	631,500	107,400,000	243,400	547,500,000	388,100	440,100,000
1927	956,000	167,400,000	207,500	42,700,000	748,500	124,700,000	190,700	351,400,000	557,800	226,700,000
1928	921,400	158,900,000	230,700	44,900,000	690,700	114,000,000	260,100	262,900,000	430,600	148,900,000
1929	1,004,500	171,700,000	254,700	44,000,000	749,800	127,700,000	418,000	353,700,000	331,800	226,000,000
1930	1,022,300	150,800,000	244,100	37,800,000	778,200	113,000,000	421,000	199,600,000	357,200	86,600,000
1931	883,200	92,100,000	241,200	26,700,000	642,000	65,400,000	393,600	99,300,000	248,400	33,900,000
1932	737,800	74,200,000	253,500	29,000,000	484,300	45,200,000	386,000	68,100,000	98,300	22,900,000
1933	770,000	66,700,000	265,700	25,600,000	504,300	41,100,000	405,300	101,400,000	99,000	60,300,000
1934	937,000	78,700,000	272,800	23,400,000	664,200	55,300,000	465,800	207,900,000	198,400	152,600,000
1935	885,100	81,100,000	314,500	40,000,000	570,600	41,100,000	415,700	191,100,000	154,900	150,000,000

* Imports include coir cordage and fibre, mats and matting, padi and rice, coffee, tea, kapok, mace and nutmegs, pepper, ginger, groundnuts and groundnut oil, sugar, tobacco, vegetables, livestock for food, meat, leather goods, milk, butter, poultry and eggs, feeding stuffs for animals, ataps, cloves, castor oil, gingelly seed, fruits, and tapioca refuse.

† Exports include rubber seed, coconut products, palm oil and kernels, canned pineapples, arecanuts, sago, tapioca, derris root, hides and skins, gambier, patchouli leaves and oil, mace and nutmegs.

The market price of coconut products improved somewhat from the very low level of the preceding year, sundried copra averaging $4.54 per picul, and coconut oil $9.13 per picul ($133\frac{1}{3}$ lbs.). The main feature of interest in relation to 1935, however, is the greatly increased production, as shewn by net exports—from 139,000 tons in 1934 to 172,000 tons in 1935, an increase due to the increase in area of palms in bearing and to a favourable cropping season. Attention is also directed to the steady rise in recent years of the production of coconut oil for export. Given favourable market conditions, it is probable that oil production will shew a further increase in 1936.

Pineapples.—With the tendency for the area under pineapples to decrease—due to the fact that new areas can no longer be developed as a catch crop with rubber—it was at one time thought probable that there would be a shortage of fruit for the canning factories. This has not yet become evident, for the net export of 73,923 tons in 1935 is an increase of 10.9 per cent. over the previous highest figure (in 1934). There seems no reason to suppose that this industry has reached its peak.

Oil Palm Products.—The production of palm oil and kernels now constitutes an agricultural export industry ranking fourth in importance. With new areas coming into bearing (only about 79 per cent. had reached the bearing stage in 1935) and other areas approaching the stage of maximum yield, the exports of these products from areas now planted must increase steadily for some years to come; until in fact, the production of oil is about 50,000 tons per annum. In 1935, therefore, Malaya had reached about half way towards maximum production from the present planted area.

Miscellaneous Products.—The remaining products shewn in Table I call for little comment in this place. Pepper is, however, omitted from the table. The net exports of pepper in 1935 were 3,563 tons valued at $6,482,271. These figures, however, do not mean that Malaya produces pepper in any quantity; the exports were from stocks held in Singapore, as the imports in 1934 greatly exceeded exports, while the enormous value was—in view of the collapse of the pepper market in London—largely a paper value.

The local production of tea is of growing importance. There is, of course, a net import of tea into Malaya, so that the Malayan production and export cannot be ascertained from the trade statistics. The total Malayan estate production of made tea in 1935 amounted to 631,662 lbs., of which 400,765 lbs. were exported, the remainder finding its way on to the local retail market.

Import Products.

There are a number of products (enumerated at the foot of Table III) which Malaya imports for local consumption. The net imports of such products in 1935 were 885,100 tons, valued at $81,100,000. Sub-division of this total shews that rice products accounted for 610,000 tons, valued at $32,855,000; livestock, meat, dairy produce and poultry 57,900 tons, valued at $3,862,000; sugar

101,000 tons, valued at $5,859,000; tobacco 5,373 tons, valued at $13,878,000; fruits and vegetables 72,000 tons, valued at $6,850,000; other products 38,827 tons, valued at $7,796,000.

The total shews a diminution in quantity, but a small increase in value.

Entrepôt Trade.

A large trade is centred on Singapore and Penang engaged in the treatment and preparation for world markets of the agricultural products of surrounding countries. The main items in this category are rubber, copra, sago and tapioca and certain of the spices. It is well-nigh impossible to assess the value of this trade, for it is also intimately connected with the entrepôt trade—which may consist merely in storage and reshipping. The nearest one can arrive at an estimate of its volume is to confine attention to the figures of gross imports. In this connexion reference is invited to columns 2 and 3 of Table I. There has been a reduction in the rubber re-milling industry in Singapore by reason of the propaganda and assistance rendered by the Government of the Netherlands Indies to small-holders, as a result of which a very large proportion of small-holders' rubber latex is now converted by them into a good quality of smoked sheet. It is understood that a contributory reason is the establishment of additional rubber re-milling factories in that country. As compared with 1934, when lower grade rubber imports were 131,863 tons, in 1935 they were 66,103 tons only.

In the year under review, the imports of tapioca were somewhat less than in the previous year, but on the other hand, the increase of imports of sago from 48,862 tons in 1934 to 61,775 tons in 1935 indicates the improved conditions of the Singapore sago refining industry.

Local Agricultural Produce.

The chief crops grown in Malaya for local consumption are rice, coconut products, vegetables, fruit, coffee and tea, besides a number of minor products. With the exception of rice, statistics are not available of the extent of production of these crops. The local production of rice in the season 1934-35 amounted to 315,078 tons, the value of which was about $19,000,000, as compared with 320,096 tons in the previous year, valued at about $16,000,000. The local production of rice fills 40 per cent. of Malayan consumption and is therefore a valuable contribution to the food requirements of the country. In addition, it is computed that the value of coconuts grown in Malaya for local consumption is about $4,000,000. Unfortunately, it is not yet possible to compute the value of the local production of fruits and vegetables; there is little doubt, however, that it exceeds the value of net imports of these products. If the value of all local produce were taken into account, it would probably be found that it was at least equal to the value of net imports of foodstuffs—in other words, Malaya has reached a position where it produces at least 50 per cent. of its food requirements.

Total Value of Agricultural Trade.

The volume and value of agricultural trade has been assessed for comparison with previous years. For this purpose, the quantity and value of the net imports of all products have been added and compared with the sum of all products of which there is a net export. From these data a balance is struck of the volume and value to Malaya of the year's trading. In 1935, the net imports amounted to 885,100 tons, valued at $81,100,000 (including rice 610,000 tons, valued at $32,855,000). Net exports (excluding rubber) were 314,500 tons, valued at $40,000,000. Malayan agricultural trade, of crops other than rubber and rice, shews an excess of exports over imports of 39,400 tons, and the value of these net exports exceeded the value of the imports by $8,253,000. This is more favourable than in the previous year, when imports exceeded exports (excluding rubber and rice) by 77,000 tons, valued at $28,000,000 and indicates the turning point in the value of these industries.

To include all imports and exports of agricultural products will give a truer picture of the agricultural trade. This balance shews that Malayan imports of agricultural products exceeded her exports by 154,900 tons (as compared with 198,400 tons in 1934), but that the value of agricultural exports exceeded imports by $150,000,000.

Received for publication on the 20th March 1936.

THE AUSTRALIAN TRADE IN COCONUT FIBRE.

An enquiry was recently received for information concerning the Australian trade in coconut fibre (coir). The following notes are drawn from a communication by H.M. Senior Trade Commissioner in Australia and from a letter from one of the principal importers.

Imports.

In the year 1934-35, 24,189 cwts. of coconut fibre were imported into Australia, of which 22,301 cwts. were from Ceylon and 1,630 cwts. from India. The total value of these imports was £5,522. Queensland was the largest importer (14,107 cwts.), while other States imported as follows:—Victoria 4,593 cwts., New South Wales 2,494 cwts., South Australia 1,542 cwts., Western Australia 1,452 cwts. and Tasmania 1 cwt.

The demand is regular but, as will be seen from the above figures, not a large one.

Packing.

There are two types of packing suitable for the Australian market. The first type is in hydraulically-pressed bales containing 2 cwts., $2\frac{1}{2}$ cwts., or 3 cwts. The measurement would be about 12 cubic feet for a 2 cwts. bale. The bale type of packing is not popular with many manufacturers as they find that the fibre is exceedingly hard to tease; they therefore prefer to pay a little extra for a looser packing. As a result, in many cases, fibre in ballots is more popular. A ballot is a small bundle of fibre varying in weight from 12 to 15 lbs., tied loosely with yarn made from coconut fibre. From 200 to 250 ballots weigh one ton.

Freight.

The freight rate on ballot fibre exported from Colombo to Australian ports is 30 rupees per ton of 6 cwts., equal to £7.2.6 sterling per ton of 2,240 lbs., while on bale fibre the freight is 40 rupees per ton of 50 cubic feet, equal to £5 sterling per long ton.

The freight on fibre is by far the largest item in the landed cost. Until recently, the f.o.b. price Colombo, of ballot fibre was exceedingly low and the price of £9.5.0 c.i.f. Sydney would represent an f.o.b. cost Colombo of £2.2.6. Bale fibre at that time was quoted at £7.12.6 per ton c.i.f. Sydney, representing £2.12.6 f.o.b. Colombo. At the end of January 1936, c.i.f. Sydney price for bale fibre was £10.0.0 and ballot fibre £11.2.6.

It is stated that the high freight charges on coconut fibre are made on the grounds that the fibre is hazardous cargo. They bear little or no relation to freight charges for other kinds of goods.

Reviews.

Vernalisation and Phasic Development of Plants.

Bulletin No. 15, Imperial Bureaux of Plant Genetics, Aberystwyth and Cambridge. December 1935, 151 pp., Price 10 shillings.

It has been popularly supposed that the growth of a plant proceeds side by side with its development, and that, as certain stages of growth are reached, certain stages of development follow more or less automatically.

During recent years, a new outlook on the problems of growth and development has arisen as a result of the theories formulated by the Odessa school of plant physiologists headed by T. D. Lysenko. According to Lysenko's theory "development consists of a series of stages, each of which requires for its completion a definite combination of external conditions. The conditions for one phase may be different from those required for others, temperature being the decisive factor for the first stage and light for the second. Each stage must be completed before the succeeding one can be initiated but once any stage has been completed there is nothing to prevent the progress of the following one, provided the necessary external conditions are forthcoming." By growth as opposed to development, Lysenko means the increase in size and weight of a plant as opposed to changes in its activity such as germination and reproduction.

By suitable treatment, the phases of development can be attained independently of growth. For example, winter wheat (which is normally sown in autumn and which is not successful if sown in spring) can be artificially stimulated to pass the phase of development which determines its reproduction (that is, its ability to produce a crop) by the treatment of the seed to certain conditions of temperature, light, humidity and aeration. The ability of the plant to bear a crop is thus pre-determined before sowing and winter wheat so treated can be sown in spring to give a satisfactory crop at the normal time in the autumn. This artificial conversion of a "winter" into a "spring" variety has given rise to the term "vernalisation".

From the practical point of view, this theory has proved of considerable importance, particularly in areas such as parts of Russia where winter crops cannot be grown owing to climatic conditions. Treated seed of winter wheat can now be sown in spring far to the north of areas where such varieties could be previously grown. The practice has recently been applied to crops other than wheat, and spinach, sugar beet and even potatoes have now been grown to maturity within the Arctic Circle.

A further effect of suitable treatment of seed is some hastening of maturity of the treated plants. The importance of this to the production of early market-garden produce is obvious.

How far the theory can be applied to plants growing under tropical conditions remains to be seen, though a certain amount of preliminary work has been

in progress in several tropical countries during the last two or three years. We know that many so-called "long day" plants seem unable to reach the phase which determines flowering under the short-day conditions experienced near the Equator. It is interesting to speculate on the possibilities of artificially inducing such plants to reach the critical phase determining flowering before growing them on to the fulfilment of this phase under normal local conditions.

The whole subject of vernalisation and phasic development is admirably summarized in the recent bulletin published jointly by the Imperial Bureaux of Plant Genetics of Aberystwyth and Cambridge. This bulletin summarizes in a comparatively brief space all the information on this most interesting subject available up to December 1935. A full bibliography and summaries of all the relevant literature are included, and the officers responsible for the compilation and editing of this work are to be congratulated on the lucid and straightforward way in which they have dealt with the extensive and complex work which has been done on this important new phase of plant-study.

B. A. L.

Imperial Bureau of Fruit Production.

Summary of Recent Work.

Imperial Bureau of Fruit Production, East Malling, Kent, England, Occasional Paper No. 4. Price 6d.

A three-page publication of the Imperial Bureau of Fruit Production, published in November, 1935, gives a summary of the recent work of the Bureau of tropical and sub-tropical interest. It is pointed out that while the Bureau Officers are chiefly concerned in the compilation of Horticultural Abstracts, a great number of which deal with tropical crops, numerous enquiries have been received from a number of countries requesting information or advice.

The Bureau is performing a very real service to those interested in fruit culture in the tropics, by personal touch, correspondence, by its publications and by the facilities provided for investigators to become acquainted with the progress of research work of a similar nature in other parts of the world.

ANNUAL PRIZE DISTRIBUTION AND SPORTS DAY, SCHOOL OF AGRICULTURE, MALAYA.

The annual prize distribution at the School of Agriculture at Serdang, took place on Thursday morning, April 9th. In addition to the staff and students there were present the Hon'ble The Director of Agriculture, S.S., and Adviser on Agriculture, Malay States (Dr. H. A. Tempany, C.B.E., M.F.C.) together with the following members of the School Advisory Committee—Lt. Colonel B. J. Eaton, O.B.E., and Messrs. Hawkins and Stanton.

The Principal, Mr. G. E. Mann, M.C., extended a welcome to Dr. Tempany and the members of the Committee. In reviewing the past year's work, Mr. Mann said, *inter alia*.

"It is customary for me on prize day to say something about the events of the past year. I believe that, during that period, the standard of training has been preserved at a satisfactory level and that the confidence shewn in the School both by Government and by the public has been well maintained. For a considerable part of the year, we have had no fewer than 76 students in residence, six more than last year and only four short of capacity; judging from the applications which have already been made for admission next May, there will be no falling off in numbers this coming year.

No fundamental changes have had to be introduced, either in the substance or in the manner of conducting the training and administration of the School. The sole addition to the curriculum is the inauguration of special evening classes in colloquial Tamil, mainly for the benefit of those students who contemplate taking up employment on estates. The innovation must be regarded at the moment as an experiment; but the reports which I have so far received indicate that the majority of the students concerned have made satisfactory progress in the language.

Of the 76 students on the past year's register, twenty-seven were private students, an increase of five over a year ago. Tuition fees, however, are at present levied in respect of all students other than some twenty-six who hold scholarships awarded by the Government of the Straits Settlements and Federated Malay States.

Of the students who have left the School in previous years, I have had favourable reports on the work of the majority—very favourable reports, in fact, in more than one case. To-day, another 47 students are leaving on the completion of their respective courses of training, and a number of these will be seeking employment in one capacity or another. Fourteen of them are returning to the Unfederated Malay States, on whose behalf they have been trained. Some four or five Malays can probably be absorbed in Government Service in the Straits Settlements and Federated Malay States, while three Chinese and three Malays will probably join the Rubber Research Institute as Asiatic Rubber Instructors. In due course, we hope to find employment for most of the remaining 10 students who have taken the Two Years Course. I have already received three offers of

employment on estates and am confident that more will follow, for the value of the School in this respect is slowly but surely making itself known.

Returning to the subject of actual training at the School, I referred a year ago to the facilities which we now have for including both practical and theoretical instruction in poultry husbandry. The School flocks have grown somewhat since then, and they continue to attract considerable interest not only from within but from outside sources. We have found it impossible to supply anything like the demand for good birds and for sittings of eggs. I would also refer to the fact that we have been able to carry out certain investigations during the past 12 months on the important problem of poor growth rate in young chicks.

As in past years, the students have shown a keen interest in all games and in their platoon of volunteers. This afternoon, we are for the first time holding annual athletic sports. They should go a long way towards encouraging the students' enthusiasm.

The usual special courses have been given at the School during vacations—a refersher course for junior officers of the Department of Agriculture, a special course for newly-appointed Asiatic Rubber Instructors, and a special course for Penghulus.

I again have pleasure in acknowledging the assistance which I have received from my staff, and in thanking a number of officers of the Co-operative Societies Department, Rubber Research Institute, and other branches of the Department of Agriculture for the valuable assistance which they have given. The staff of the Central Experiment Station, Serdang, deserve specially warm thanks in this respect.

Finally, Sir, I must express on behalf of the School our profound regret that you will shortly be leaving us, the respect and affection with which we shall remember you, and our sincere hope that your new appointment will one day afford you an opportunity of re-visiting us. Colonel Eaton also is soon leaving Malaya, and our best wishes for a happy retirement will certainly accompany him''.

Mr. Mann then called upon Dr. Tempany to distribute the prizes, diplomas and certificates which had been awarded in respect of the various courses of training, at the conclusion of which Dr. Tempany congratulated the successful students and in the course of his address said:—

''For me this occasion to-day has something of sadness about it, for it is probably the last opportunity that I shall have of addressing those associated with the School of Agriculture, Malaya, as I am leaving this country permanently in little more than a month's time.

But it is a source of considerable satisfaction to me to know that, after five years of existence, this School is firmly established and that it is fulfilling in large measure the aims and objects with which it was inaugurated. I count it a very great honour that it has fallen to my lot to see this institution started during my tenure of office as head of the Agricultural Department in this country and to

have borne some part in bringing about the very satisfactory situation with which we are confronted to-day.

At such a time as this it is permissible to look back on the past; during these five years there have been many anxious moments, the country has passed through a period of black depression, the like of which, I trust, we shall never see again; and during that time the fate of this School hung for a while trembling in the balance, before it had had time to demonstrate its utility. Fortunately the threatened blow was averted, and the School was given the opportunity which it deserved of proving its utility; of this opportunity, I think, full advantage has been taken.

This School is now full almost to capacity; next year the demands for admission bid fair to exceed the available accommodation. This in itself, I think, is the strongest tribute which the public of Malaya could pay to the School.

Another event of considerable interest is the coming into being of what may be termed the first child of the School in the shape of the Farm School at Malacca which started work last September. A second Farm School will, it is hoped, be opened in Penang next year and possibly a third in Singapore.

The course of instruction at these Farm Schools is of a somewhat lower standard than that of our one year course, but like it, however, the instruction is essentially practical and is intended particularly to benefit the sons of small-holders.

If these ventures succeed, as I hope they will, there seems to be no reason why there should not ultimately arise a chain of Farm Schools extending throughout the Peninsula, with this institution at the head of the chain.

For the success which this School has achieved no small amount of credit is due to Mr. Mann, the Principal, and his staff; it is with pleasure that I express my appreciation of the hard work which they have performed during these years.

I shall leave this country with very deep regret. Its charm and the wide diversity of its agricultural interests give to it a fascination that is all its own; I believe that its future can be very bright; I believe that there is no tropical country that possesses greater potentialities. It is favoured in that it possesses an Asiatic agricultural population that is inately intelligent; to-day it occupies a leading place among British tropical possessions; but if it is to maintain that position in the face of the severe competition which is everywhere the rule, it is necessary to maintain a progressive outlook. The country cannot stand still, it must either go forward or go back.

For progress full advantage must be taken of any opportunity that offers and people must be receptive of new ideas. In achieving progress the system of agricultural education, of which this School forms a part, can play a rôle of the highest importance. Of that I am firmly convinced.

I shall watch the future progress of this School with unfailing interest and if in the future it should rise to heights of which we do not dream at present, I shall feel an abiding sense of satisfaction.

I would like to wish every student present all possible success and would also like to express my very deep appreciation of the very happy and cordial

relations which have prevailed between myself and the staff as well as students and pupils of the School throughout my tenure of office.

Finally I would like to thank the Advisory Committee for their never failing help and support which has been freely forthcoming at all times".

Colonel Eaton said *inter alia*:—

"Since this is the last occasion on which I shall have the pleasure of attending your Annual Prize Giving, I should like to express my thanks to your Principal for the opportunity of making a few remarks.

As most of you are aware, in the Rubber Research Institute there are at present fourteen former students of this School and I hope this year we may get six or eight more to complete our cadre in the Small-Holders' Advisory Service of Rubber Instructors.

You will therefore realize that I have had some opportunity of assessing the value of the instruction which you have received at the School, and how it has been applied in practice, since every month I read a report compiled by each of the 14 Instructors.

With few exceptions, I can tell you that these reports are excellent and indicate that our Instructors have benefited by the training they have received here as students and several of them have shown initiative in applying their training.

There are two thoughts only which I should like to impress on you all—they are the value of observation and the cultivation of a critical faculty. In scientific work particularly—as also in other branches of learning—no real advances in knowledge are made unless we are keen observers, have a critical faculty and can draw deductions from our observations. Your observations can often be of the greatest value also to those who may have a little more experience and knowledge than yourself.

Your are aware of the economical and useful rubber smoke house which we are now recommending for use on small holdings. It has developed entirely from an observation made by a former student of this School who is one of our Rubber Instructors, and credit is due to him for observing this type of smoke house on a small holding and sending us drawings and a description on which we were able to make further improvements. Since that, several other Instructors have sent us useful suggestions for alternative construction.

In closing, I wish you all the greatest success and would predict that even though some of those present may in the future undertake work other than of an agricultural nature you will still find your training here, owing to a combination of its breadth and fundamental nature, to be of the greatest value".

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports submitted by Agricultural Officers.

March, 1936.

The Weather.

On the east coast of Pahang and Johore the weather was cool and wet with a precipitation nearly double the average.

Elsewhere the shorter dry season terminated in most parts of the Peninsula during or at the end of the second week of March, but around Taiping and in parts of Lower Perak and Ulu Selangor Districts it continued until the end of the third week of March. For the remainder of the month showers and thunderstorms, of varying frequency and intensity, were experienced giving a rainfall which varied considerably in different regions. It was above average in Kedah and Province Wellesley, around Tanjong Malim, in central Johore and along the west coast from the mouth of the Perak River southward. It was about average in Krian and Kelantan and below average over the remainder of the country.

Remarks on Crops.

Padi.—Harvest was completed in the Tanjong Karang *mukim* of Kuala Selangor District, in Negri Sembilan and in Malacca; it was nearly completed in Kedah, Penang and Province Wellesley except the Sungei Acheh area, Krian and other parts of Perak except Larut and Bruas Districts, and in the road mukims of Lipis and Raub Districts in Pahang.

Reaping was in full progress in Larut and Bruas Districts of Perak, in the Panchang Bedena *mukim* of Selangor, in Kelantan and the coastal mukims of eastern Pahang.

Reports indicate that the crop in Kedah is satisfactory, but that yields in the Settlements of Penang will be below those of the previous season, although they were good in the Northern District of Province Wellesley. In Krian the planted area is roughly estimated as 48,980 acres or about the same as in the previous season, but the crop of some 16,750,000 gantangs shows a decrease. The crop was quite fair in Central Perak except Bruas District, but in the Sungei Manik area in Lower Perak yields were disappointing, being below those anticipated earlier in the season. Yields from measured plots gave 350 gantangs per acre in the older part of this area and 290 gantangs per acre in the recently developed portion.

In Selangor the Tanjong Karang crop was satisfactory and from the Panchang Bedena and Sungei Panjang mukims a good surplus of padi is expected. In

Panchang Bedena *mukim* crop-cutting tests on plots of Siam 29 grown from Government seed gave yields ranging from 500 to 680 gantangs per acre.

Returns so far received indicate that the Negri Sembilan crop will be slightly below that of the previous season. In Malacca a poor crop in Alor Gajah District was offset by good yields elsewhere, so that the total for the Settlement should be about the same as in 1935. In Kelantan also in spite of wet weather during harvest the crop is expected to be satisfactory and about the same as that of last year.

In Krian the Government mills purchased at a premium of 1 cent some 410,000 gantangs of unmixed padi of the strain Seraup 48.

Supplies of padi for the Government Mill at Temerloh continued to come forward and the mill began working again on the 2nd March.

In the Temerloh District of Pahang nurseries were sown and preparation of the land was commenced. There was a notable increase in the use of implements for this work as a result of the demonstrations previously given. The construction of bunds and other work on the new Kerdau Test Plot in this District were closely watched by neighbouring cultivators and copied by some of them.

Dry nurseries for seedlings are in almost universal use in Pahang and are often planted on State Land. This practice is wasteful of land and involves a risk of losing the young plants through drought. Demonstrations of the advantages of wet nurseries were given in Lipis District.

Rubber.—Wintering came to an end during the month and at its close there was a good growth of new foliage on the trees. The production of both new leaf and flower after wintering was in many localities heavier than has been seen during the past few years, as the showery weather during the second half of the month was favourable to the new growth.

Leaf mildew (*Oidium Heveae*) was present on estates and small holdings in parts of Penang and Province Wellesley and the Sitiawan and Batang Padang Districts of Perak. It was generally distributed throughout Selangor, Negri Sembilan, Malacca and Johore, but was not reported from Kedah, Pahang or Kelantan. Except on one or two estates the attack was considerably milder and did less damage than that experienced in 1935, as weather conditions were less favourable to the growth of the fungus.

There was a further reduction in the number of holdings in tapping in all localities, except northern Pahang. This was mainly due to the exhaustion of export coupons at the end of the quarter, which resulted in maintaining a high price for coupons and a low price for rubber without coupons. Contributory factors were pre-occupation with padi harvest, the effect of wintering on yield and, in some localities, unfavourable weather conditions. It is reported from Negri Sembilan that cessation of tapping on so many small holdings is causing hardship to those members of the rural population who, owning no land, are dependent for a living on obtaining employment as hired tappers on neighbouring small holdings.

The difference between the price of smoked and that of unsmoked sheet continued to be small, but in spite of the discouraging effect of this narrow margin on the production of smoked sheet, additional small-holders' smoke cabinets were erected in several localities.

In Pahang arrangements have been completed whereby each rubber dealer displays samples of different grades of rubber with the local price for the day of each grade. The producer can thus see at once to which grade his rubber belongs, what price is offered for it, and what additional price he might have obtained had it been of better quality. This scheme has already resulted in the production of a higher percentage of the better grades in Temerloh District.

Copra.—A special course in copra making and the construction of miniature kilns was given to seven Malay Officers from Johore at the Klang Coconut Experiment Station during the period March 9th to 11th.

Elsewhere in this number is an article by the Officer-in-Charge of Copra Investigations describing types of kilns recently designed for small-holders. In Bagan Datoh District one 30-acre kiln was erected by Government for demonstration purposes, but did not meet the requirements of small-holders in that area because its capacity was so small that its owner would have to devote so many days each month to copra making that he would have insufficient time left to devote to other forms of work from which to supplement his income. Consequently a twin kiln of twice the capacity was erected and tested in this District during March. This attracted considerably greater interest.

In the coconut areas of the west coast of Johore five 30-acre kilns have recently been completed for demonstration purposes and have in trial working produced copra of satisfactory quality. Two of these kilns in Muar District cost \$11.39 and \$11.34 respectively, exclusive of labour. These small kilns have attracted considerable attention in Johore.

A demonstration kiln of each of these two types has been erected in Kuala Selangor and a 30-acre kiln has been built at the Farm School on the Sungei Udang Agricultural Station in Malacca.

The slight fall in the price of copra during the month did not result in loss of interest in copra-making in most areas, though it is stated that small-holders in Klang District ceased making copra.

In Province Wellesley the price of nuts still remained high in spite of increased yields and copra making was not profitable.

In the Southern District of the Province coconuts suffered from combined attacks of the caterpillars of *Hidari irava,* (the skipper butterfly), *Chalcoscelis albiguttata* (the gelatine grub), and *Parasa lepida* (a stinging caterpillar). The attacks of the first and last mentioned caterpillars appear to have terminated, though they have been responsible for most of the damage.

Agricultural Stations and Padi Test Plots.

At the Gajah Mati Agricultural Station in Kedah pepper vines growing on living supports of *Gliricidia maculata* and Dadap (*Erythrina* spp.) have not done

well. Hard-wood poles are now being substituted. Good progress was made with the development of the new Ayer Itam Agricultural Station in Penang, which has already begun to attract visitors.

At the Kuala Kangsar Agricultural Station hot dry weather during the month caused the death of a number of young rambutan and durian buddings, which had taken successfully in February, in spite of careful attention to extra shading and watering. Preparation for planting the area recently added to this Station proceeded satisfactorily.

In Johore the clearing of the new Agricultural Station at Tangkah was nearly completed. A cover crop was sown and sub-division into half-acre blocks was commenced. Progress was also made in preparing the site of the new Central Experiment Station of 30 acres at Ayer Hitam.

Harvest has been completed on most of the Padi Stations and Test Plots and the results of experiments are now being examined and analysed by officers of the Research Branch.

On the Dong Padi Test Plot in Pahang yields were much below those of the previous season. The best yielding pure strains were Milek Kuning 3 with 456 gantangs, Siam 29 with 440 gantangs, Radin 2 with 420 gantangs and Nachin 11 with 417 gantangs per acre. The highest yielding local variety was Serendah Puteh with 390 gantangs per acre.

On the Tanjong Karang Test Plot in Selangor, Reyong 20 in one Latin Square yielded at the rate of 620 gantangs per acre, while Radin 2 and Radin China 12 also did well with over 550 gantangs per acre.

In Pahang a new Test Plot has been opened at Kerdau in place of that formerly used at Temerloh. Nurseries were sown on this plot and preparation of the land with implements was commenced. Sowing of nurseries and preparation of the land were also in progress on the Bawang and Pekan Test Plots in Pekan District.

All-Malayan Padi Competition.

Mukim padi competitions were held in nine centres in the Serendah District of Negri Sembilan. Total exhibits again showed a decrease. Local cultivators now realize that a high standard of exhibit is required and that the local practice of cultivating two or more types of padi on small areas combined with lack of care in selecting the seed renders the production of unmixed samples of grain for exhibition purposes a matter of considerable difficulty.

In contrast to this was the increase in number and improvement in quality of the exhibits brought to the three local competitions in the down river mukims of Kuala Lipis District in Pahang. Moreover the cultivators themselves took a great interest in these Shows and asked a large number of questions after judging had been completed. The State Agricultural Officer received valuable assistance from the District Officer, Lipis, at all three centres both in judging the padi and in explaining the purpose of the Shows and other matters to the exhibitors.

DEPARTMENTAL NOTES.

Appointment of Dr. H. A. Tempany as Assistant Agricultural Adviser to the Secretary of State for the Colonies.

The Hon'ble Dr. H. A. Tempany, C.B.E., D.SC., F.I.C., F.C.S., Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States, has been appointed Assistant Agricultural Adviser to the Secretary of State for the Colonies, and will assume the duties of his new appointment about the 24th July 1936.

In consequence of this appointment Dr. Tempany retires from his present post which he has held since 6th January, 1929, and expects to leave Malaya on 23rd May, 1936.

Exhibition to Tourists at Malacca.

As has been the custom in past years, an exhibition of local agricultural products was staged in Malacca on the occasion of the visit of the s.s. "Reliance" on 10th March 1936. This exhibition was prepared at the request of the Agents, Messrs. Sime, Darby & Co. Ltd., with whose assistance and that of the Rubber Research Institute of Malaya a thoroughly comprehensive exhibit was staged which appeared to be much appreciated by the visitors.

Tour of the Rural Lecture Caravan.

The Rural Lecture Caravan toured Upper Perak, Parit, Bruas and Sitiawan Districts during the month. Successful shows were held in all centres visited. Special interest was shown in the small-holders' rubber smoking cabinet and the kampong poultry house.

ANTI-MALARIA PRECAUTIONS.

Published at the request of the Malaria Advisory Board, F.M.S.

The Malaria Advisory Board invites the attention of planters to the danger to health, likely to arise during the replanting of rubber, from the breeding of anopheline mosquitoes in pits left by the uprooting of trees and in holes prepared for replanting. Care should be taken to avoid the accumulation of water in such places, within half-a-mile of houses, as they may rapidly become the source of large numbers of *Anopheles maculatus* and other malaria-carrying mosquitoes.

Pits left by the uprooting of old trees should be filled up immediately. It is suggested that holes prepared for replanting, which are likely to become a source of mosquito breeding, should be kept *filled* with cut vegetation. Planting should, however, be undertaken as early as possible.

Statistical.

MARKET PRICES.

March, 1936.

Major Crops.

Rubber.—The market continued and maintained its improved condition, and, after the early part of the month, the price in Singapore did not fall below 26 cents per lb. Spot loose opened at $25\frac{1}{2}$ cents per lb. and closed at $26\frac{1}{8}$ cents per lb. The average price for March of No. 1 X. Rubber Smoked Sheet was 26.04 cents per lb. as compared with 25.38 cents in the previous month. The average price in London was 7.44 pence per lb., and in New York 15.86 cents gold, as compared with 7.27 pence and 15.38 cents gold in February.

Prices paid for small-holders' rubber at three centres during the month are shewn in the following table.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, March, 1936.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.		Kuala Kangsar, Perak.			Batu Pahat, Johore.		
	5	12	4	11	25	4	11	18
Smoked sheet	32.60	33.35	32.87	33.10	33.40	32.50	33.00	
Unsmoked sheet		32.00				30.60	31.30	31.80
Scrap		28.00						

Transport by F. M. S. R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent

No purchases at Batu Pahat on the 25th, at Kuala Kangsar on the 18th, and at Kuala Pilah on the 19th and 26th March.

Palm Oil.—Prices weakened very considerably during March as shewn in the following table.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1936.	Palm Oil in Bulk, c i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
Feb. 28	19. 0. 0	10. 12. 6
Mar. 6	18. 0. 0	10. 0. 0
,, 13	18. 0. 0	10. 0. 0
,, 20	18. 0. 0	10. 0. 0
,, 27	18. 2. 6	10. 0. 0

Copra.—Prices weakened still further during the first half of March, but recovered and remained stable in the second half. The sun-dried grade opened in Singapore at $5.05 per picul, fell to $4.75, and closed at $5.20, the average for the month being $5.09 per picul as compared with $5.68 in February. The mixed quality was consistently 50 cents lower, averaging $4.59 as compared with $5.16 in the previous month.

Copra cake improved to $1.40 per picul in the second half of the month, the average being $1.32 as against $1.34 in February.

Rice.—The average wholesale prices of rice per picul in Singapore for February were as follows:—Siam No. 2 (ordinary) $3.81, Rangoon No. 1 $3.35, Saigon $3.35, as compared with the previous month's corresponding prices of $3.64, $3.45 and $3.37. February 1935 prices were $3.37, $3.25 and $3.32.

The average retail market prices in cents per gantang of No. 2 Siam rice in February were:—Singapore 32, Penang 28, Malacca 26, as compared with 34, 30 and 26 respectively in January.

The average declared trade value of imports of rice in February was $3.46 per picul, as compared with $3.64 in January and $3.63 in December 1935.

Padi.—The Government Rice Mill at Bagan Serai raised its price for padi from $1.70 to $1.80 per picul at the beginning of the month, and at Parit Buntar to $1.85. The price was subsequently raised to $2, and later, towards the end of the month, to $2.20 per picul. Retail prices per gantang ranged from 5 to 13 cents in different parts of the country.

Pineapples.—Prices in Singapore were reduced during March by the Packers' Combine, and closing prices per case were:—Cubes $3.20, Sliced Flat $3.10, Sliced

Tall $3.20. Average prices for the month were $3.27, $3.16 and $3.25 respectively as compared with $3.45, $3.25 and $3.35 in February.

Prices of fresh fruit per 100 were:—Selangor $1 to $3; Singapore $2.90 to $3.10; Johore, 1st quality $2 to $5, 2nd quality $1.50 to $3.50, 3rd quality 80 cents to $2.

Beverages.

Tea.—Ten consignments of Malayan tea were sold on the London market during March. One consignment of highland tea averaged 1s. 0¾d. per lb., and the remaining consignments—of lowland tea—were sold at prices ranging from 11¾d. to 1s. 0½d. per lb., the average being 1s. 0⅛d. per lb.

Average London prices per lb. during March for tea consignments from other countries were as follows:—Ceylon 1s. 3.11d., Java 11.09d., Indian Northern 1s. 1.06d., Indian Southern 1s. 1.52d., Sumatra 10.59d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report*, 31st March, 1936, of the Colombo Brokers' Association, and are as follows (rupee cents per lb.):—High Grown Teas 74 cents, Medium Grown Teas 62 cents, Low Grown Teas 59 cents.

Coffee.—Prices for Sourabaya coffee were lower than in the previous month, but improved slightly at the close, opening at $12 to $13 per picul and rising to $13.50 to $14.50. Palembang coffee weakened slightly also, the average price for the month ranging from $7.31 to $8.37 per picul, as compared with $7.38 to $8.38 in February.

Prices of locally-grown coffee continued low, ranging from $12 to $28 per picul.

Spices.

Arecanuts.—Prices in Singapore fell still further during March with the exception of Sliced which shewed an improvement over the previous month. Average prices per picul were:—Splits $4 to $5.56; Red Whole $3.87 to $4.81; Sliced $8.12 to $9.31.

The Singapore Chamber of Commerce average prices per picul were:—Best $6.17, Medium $5.60, Mixed $4.35, as compared with $6.41, $5.89 and $4.82 respectively in February.

Pepper.—Prices in Singapore continue to be virtually nominal with practically no business passing. Prices per picul in March remained unchanged and were:—Singapore Black $8.50, Singapore White $16, Muntok White $16.50. February average prices per picul were $8.90, $16.30 and $16.80 respectively.

Nutmegs.—Prices fell still further in Singapore in the first half of the month, but improved slightly at the close; 110's averaged $28.25 per picul, and 80's $29 per picul, as compared with $32 and $32.80 respectively in February.

Mace.—Siouw weakened slightly, averaging $92.50 per picul as against $102 in February, and Amboina improved to average $73.75 as compared with $73 per picul.

Cloves.—Nominal quotations were marked up slightly at the close of March to $38 per picul for both Zanzibar and Amboina.

Cardamoms.—According to the Ceylon Chamber of Commerce weekly reports green cardamoms were quoted during March at Rs. 1.15 to Rs. 1.27 per lb. rising to Rs. 1.25 to Rs. 1.31.

Miscellaneous.

Tuba Root (*Derris*).—The Singapore market continued to improve during March. The average price for roots sold on rotenone content was $52 per picul, and for roots sold on a basis of ether extract was $34.50. These prices shewed an improvement of $3 per picul over the February averages.

Gambier.—Singapore prices continued unchanged at the February levels; they were:—Block $6.50, and No. 1 Cube $10.50 per picul.

Tapioca.—Tapioca prices also remained unchanged and were:—Flake Fair $5.50, Seed Pearl $5.50, Medium Pearl $6.50 per picul.

Sago.—Pearl, Small Fair, improved slightly to average $3.75 per picul, while Flour, Sarawak Fair, was quoted throughout the month at $2.35 per picul as compared with the average price of $2.48 per picul in February.

Tobacco.—Prices of locally grown tobacco varied considerably in different parts of the country. In Selangor first quality ranged from $60 to $90 per picul and in Kelantan also first quality was quoted at $90, 2nd and 3rd qualities being $70 and $45 respectively. Elsewhere prices were: 1st quality $25 to $60, 2nd quality $16 to $35, 3rd quality $10 to $20.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross. London, S.W.1.

GENERAL RICE SUMMARY*

February, 1936.

Malaya.—Imports of foreign rice during February were 64,203 tons, and exports 14,493 tons. Net imports for January and February were 83,936 tons, an increase of 17.4 per cent. as compared with 1935†.

Of the imports during February, 54 per cent. were consigned to Singapore, 16 per cent. to Penang, 7 per cent. to Malacca, 20 per cent. to the Federated Malay States and 3 per cent. to the Unfederated Malay States. Of the total, 68 per cent. were from Siam, 26 per cent. from Burma, 5 per cent. from French Indo-China, and 1 per cent. from other countries.

Of the February exports, 73 per cent. were consigned to the Netherlands Indies and 27 per cent. to other countries. The various kinds of rice exported were:—(in tons, percentages in brackets) Siam 11,225 (77.4), Burma 2,490 (17.2), French Indo-China 690 (4.8), parboiled 26 (0.2), local production 62 (0.4).

India and Burma.—Foreign exports during January were 77,000 tons, a decrease of 18.1 per cent. when compared with 94,000 tons in the previous year. Of these exports 2.6 per cent. were to the United Kingdom, 1.3 per cent. to the Continent of Europe, 58.4 per cent. to Ceylon, 26.0 per cent. to the Straits Settlements and the Far East, and 11.7 per cent. to other countries. The corresponding 1935 percentages were:—2.1, 1.1, 44.7, 36.2 and 15.9.

Burma's total exports of rice and bran (*Bangkok Times,* 2nd March, 1936) during January were 274,655 metric tons, as compared with 315,135 metric tons in 1935, a decrease of 12.8 per cent.

According to the final rice forecast for All-India for the 1935-36 season (*Indian Trade Journal,* 5th March, 1936) the total yield is estimated at 27,719,000 tons as compared with 30,261,000 tons in the 1934-35 season. The exportable surplus of the Burma crop is estimated to be 3,500,000 tons of rice and rice products.

Siam.—Exports of rice and rice products from Bangkok during January are provisionally given as 141,060 tons as compared with 164,362 tons in 1935.

The estimated exportable surplus of rice and rice products, including the balance from 1935, is 1,672,681 tons.

Japan.—The latest information available was published in the Rice Summary for January.

French Indo-China.—Entries of padi into Cholon during January and February totalled 318,851 metric tons as compared with 350,015 metric tons in 1935, a decrease of 8.9 per cent. Exports of rice were 222,803 metric tons, a decrease of 27.5 per cent. as against 307,471 metric tons.

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* Abridged from the Rice Summary for February, 1936, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935.

Netherlands Indies.—According to *The Netherlands Indies Economic Bulletin,* 1st March, 1936, the area under padi harvested during 1935 was 9,346,480 acres as compared with 8,336,250 acres in 1934.

Imports of rice during 1935 totalled 387,120 metric tons as compared with 278,836 metric tons in the previous year, an increase of 38.8 per cent.

Ceylon.—Imports for the first two months of the year aggregated 100,543 tons, an increase of 18.4 per cent. as compared with 84,912 tons in the previous year.

Of these imports, 8.8 per cent. were from British India, 64.3 per cent. from Burma, nil from the Straits Settlements and 26.9 per cent. from other countries. The corresponding 1935 percentages were 13.5, 71.2, 1.6 and 13.7.

Europe and America.—Shipments to Europe from the East during the period 1st January to 13th February amounted to 28,614 tons, as compared with 17,671 tons in 1935, an increase of 61.9 per cent. Of these, 50.1 per cent. were from Burma, 39.5 per cent. from Siagon, 6.4 per cent. from Siam, and 4 per cent. from Bengal. The relative percentages for 1935 were 30.7, 40.8, 20.3, and 8.2.

Shipments for the Levant for the same period were 2,296 tons, a decrease of 60.4 per cent., and to Cuba, West Indies and America from the 1st January to 15th February were 11,009 tons, an increase of 26.5 per cent.

MALAYAN AGRICULTURAL EXPORTS, January and February, 1936.

PRODUCT.	Net Exports in Tons					
	Year 1935	Jan.-Feb. 1935	Jan.-Feb. 1936	February 1935	January 1936	February 1936
Arecanuts ...	21,885	3,624	5,819	856	3,165	2,654
Coconuts, fresh †	106,272†	14,745†	17,512†	7,593†	9,629†	7,883†
Coconut oil ...	35,911	4,565	6,619	2,061	3,130	3,489
Copra ...	111,752	23,090	8,933	11,904	7,292	1,641
Gambier, all kinds	2,837	422	415	182	200	215
Oil cakes ...	11,361	1,775	1,557	852	1,054	503
Palm kernels ...	3,892	560	582	215	402	180
Palm oil ...	24,996	3,176	3,338	1,911	1,610	1,728
Pineapples canned	73,923	9,624	11,532	5,156	6,788	4,744
Rubber ¶ ...	378,381¶	67,130¶	60,599¶	30,109¶	33,329¶	27,270¶
Sago,—flour ...	10,920	2,706	1,301*	799	339	1,640*
,, —pearl ...	4,655	789	459	286	277	182
,, —raw ...	7,735*	1,140*	1,335*	444*	960*	375*
Tapioca,—flake ...	1,953	396	322	159	165	157
,, —flour ...	755*	115*	274*	148	7	281*
,, —pearl ...	17,169	2,011	1,944	1,052	990	954
Tuba root ...	567	136½	117	95½	67	50

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION (IN TONS) OF PALM OIL AND KERNELS

(As declared by Estates)

Month 1936	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S.
January ...	1,395.4	326.5	258.6	37.2
February ...	1,531.9	372.4	244.2	54.6
Total ...	2,927.3	698.9	502.8	91.8
Total Jan. and Feb. 1935 ...	2,039.7	560.2	335.7	88.1
Total for year 1935 ...	17,338.7	5,764.6	2,711.1	818.4

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 29TH FEBRUARY, 1936.

State or Territory (1)	Acreage of Tappable Rubber end 1934 (2)	Estates which have entirely ceased tapping: Acreage (3)	Estates which have entirely ceased tapping: Percentage of (3) to (2) (4)	Estates which have partly ceased tapping (a): Acreage (5)	Estates which have partly ceased tapping (a): Percentage of (5) to (2) (6)	Area of tappable rubber never been tapped: Acreage (7)	Area of tappable rubber never been tapped: Percentage of (7) to (2) (8)	Total (3) + (5) (9)	Percentage of (9) to (2) (10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,691	965	2.1	15,724	35.2	688	1.5	16,689	37.3
Malacca	123,793	1,955	1.6	32,820	26.5	3,425	2.8	34,775	28.1
Penang Island	2,593	Nil	Nil	610	23.5	254	9.8	610	23.5
Singapore Island	33,312	3,222	9.7	9,342	28.0	417	1.3	12,564	37.7
Total S.S. ...	204,389	6,142	3.0	58,496	28.6	4,784	2.3	64,638	31.6
FEDERATED MALAY STATES :—									
Perak	295,895	10,580	3.6	70,854	23.9	14,978	5.1	81,434	27.5
Selangor	345,100	11,488	3.3	73,607	21.3	15,497	4.5	85,095	24.6
Negri Sembilan	258,381	13,231	5.1	56,460	21.9	17,168	6.6	69,691	27.0
Pahang	75,912	10,701	14.1	26,444	34.8	17,929	23.6	37,145	48.9
Total F.M.S. ...	975,288	46,000	4.7	227,365	23.3	65,572	6.7	273,365	28.0
UNFEDERATED MALAY STATES :—									
Johore	417,633	19,451	4.7	70,821	16.9	41,753	10.0	90,272	21.6
Kedah	199,180	3,880	1.9	22,423	11.3	19,349	9.7	26,303	13.2
Kelantan	28,891	403	1.4	12,489	43.2	7,688	26.6	12,892	44.6
Trengganu (b)	4,643	Nil	Nil	15	0.3	179	3.9	15	0.3
Perlis (c)	1,206	Nil	Nil	719	59.6	64	5.3	719	59.6
Brunei	(d) 4,991	Nil	Nil	1,588	31.8	856	17.2	1,588	31.8
Total U.M.S. ...	656,544	23,734	3.6	108,055	16.5	69,889	10.6	131,789	20.1
TOTAL MALAYA ...	1,836,221	75,876	4.1	393,916	21.5	140,245	7.6	469,792	25.6

Notes :—(*a*) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.

(*b*) Registered Companies only.

(*c*) Rendered quarterly.

(*d*) Acreage of tappable rubber on 1st May, 1934.

MALAYAN RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF FEBRUARY, 1936, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January and Feb. 1936		during the month		January and Feb. 1936						
	Ports	Dealers	Estates of 100 acres and over	during the month	January and Feb. 1936	during the month	January and Feb. 1936	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January and Feb. 1936
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	7,894	11,630	10,048	20,258	3,963	11,007	Nil	Nil	Nil	Nil	9,025	5,153	21,319	9,107	...	7,262	12,088	7	13
Johore ...	...	2,384	3,755	4,090	8,201	2,636	6,512	Nil	30	Nil	58	2,096	4,583	4,025	10,384	...	2,091	4,125	...	...
Kedah ...	...	386	2,947	2,318	5,697	624	1,129	Nil	Nil	Nil	Nil	1,140	1,841	2,585	4,512	...	220	3,074	...	...
Perlis ...	...	25	18	12	25	11	52	Nil	Nil	Nil	Nil	Nil	37	Nil	72	...	12	17	...	...
Kelantan ...	...	425	271	318	586	441	1,117	Nil	Nil	Nil	Nil	100	737	279	1,357	...	309	309	...	...
Trengganu ...	...	55	50	212	379	106	190	Nil	Nil	Nil	Nil	Nil	318	Nil	569	...	55	50	...	...
Brunei	...	8	47	47	100	67	134	...	...	...	...	...	113	...	231	...	17	39	...	...
Total Malay States	...	11,177	18,718	17,045	35,246	7,848	20,141	Nil	30	Nil	58	12,361	12,782	28,208	26,232	...	9,966	19,702	7	13
S. SETTLEMENTS :-																				
Malacca ...	...	2,331	1,147	1,004	2,117	454	1,208	Nil		Nil		1,935		4,535		...	1,758	1,203	...	...
Province Wellesley	...	1,357	499	380	840	221	463	Nil		Nil		7,747		15,962		...	772	497	...	...
Penang ...	2,246	6,138	11	16	34	56	97	3,046	10,891	5,590	23,278		Nil		Nil	2,696	6,020	10	...	...
Singapore ...	4,071	18,740	170	153	311	76	113	15,720		25,656		16,393		28,832		4,739	24,966	186	21	43
Labuan	...	13	Nil	Nil	Nil	17	29	91		193		Nil		Nil		...	15	Nil	...	...
Total Straits Settlements	6,317	28,579	1,827	1,553	3,302	824	1,910	18,857	10,891	31,439	23,278	26,075	Nil	49,329	Nil	7,435	33,531	1,896	21	43
TOTAL MALAYA	6,317	39,756	20,545	18,598	38,548	8,672	22,051	18,857	10,921	31,439	23,336	38,436	12,782	77,537	26,232	7,435	43,497	21,598	28	56

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	6,416	24,312	5,853	2,258	1814	130
WET RUBBER	846	654	167	304	277	90
TOTAL ...	7,262	24,966	6,020	2,562	2,091	220

TABLE III
FOREIGN EXPORTS

PORTS 29	For month 30	January and Feb. 1936 31
Singapore ...	23,649	45,904
Penang ...	10,810	22,047
Port Swettenham.	3,702	9,168
Malacca ...	275	418
MALAYA ...	38,436	77,537

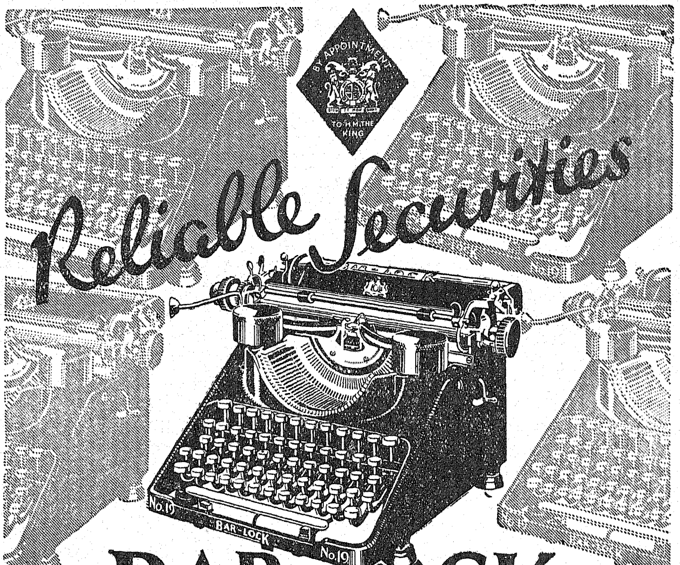
TABLE IV
DOMESTIC EXPORTS 4

AREA 32	For month 33	January and Feb. 1936 34
Malay States ...	25,143	54,440
Straits Settlements	2,381	4,969
MALAYA ...	27,524	59,409

Notes:—
1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 25 March, 1936.

METEOROLOGICAL SUMMARY, MALAYA, FEBRUARY, 1936.

Locality.	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B.	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total. in.	Total. mm.	Most in a day. Amt.	Number of days: Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total.	Daily Mean.	Per cent.
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	93.0	71.6	82.3	96	69	88	76	84.5	84.7	7.27	184.7	1.34	15	13	5	2	1	224.45	7.74	65
Bukit Jeram, Selangor ...	89.0	72.3	80.7	92	69	85	75	84.7	85.7	2.55	64.8	1.44	9	6	2	1		251.30	8.67	72
Sitiawan, Perak ...	89.8	73.4	81.6	93	69	85	77	83.7	83.8	4.38	111.3	3.08	10	8	2		1	217.25	7.49	63
Temerloh, Pahang ...	89.3	71.7	80.5	93	67	85	75	85.1	84.7	2.11	53.6	0.85	9	8	1	7		206.60	7.12	59
Kuala Lipis, Pahang ...	89.1	71.1	80.1	92	68	86	74	83.3	83.2	5.68	144.3	2.60	7	6	3	12		205.85	7.10	59
Kuala Pahang, Pahang ...	85.2	75.2	80.2	87	72	83	79	84.1	83.6	3.72	94.5	1.29	11	8				239.65	8.26	69
Kallang Aerodrome, S'pore ...	87.7	75.2	81.5	90	73	84	78	82.7	83.1	1.12	28.5	0.37	9	6	1			207.45	7.15	59
Butterworth, Province Wellesley ...	88.7	73.1	80.9	91	69	85	77	85.9	85.1	0.15	3.8	0.08	5	1				247.25	8.53	72
Bayan Lepas Aerodrome, Penang ...	89.1	73.1	81.1	92	67	85	76	84.3	84.0	1.02	25.9	0.32	6	5				231.85	7.99	67
Bukit China, Malacca ...	88.4	73.7	81.1	92	71	84	76	84.5	84.2	2.24	56.9	1.67	10	5	2			229.35	7.91	65
Kluang, Johore ...	88.3	71.3	79.8	92	68	80	74	81.0	81.3	7.25	184.2	2.32	13	11	2	7	2	194.45	6.71	55
Bukit Lalang, Mersing, Johore	83.7	72.6	78.1	87	69	82	77	80.5	79.9	1.72	43.7	1.27	4	3		1		230.20	7.94	66
Alor Star, Kedah ...	90.6	70.7	80.7	94	66	85	75	84.1	84.7	1.51	38.4	1.47	3	1	1	1		268.10	9.24	78
Kota Bahru, Kelantan ...	86.7	71.3	79.0	91	67	80	74	81.8	82.5	8.34	211.8	3.27	8	6		2		246.65	8.51	71
Kuala Trengganu, Trengganu	86.2	71.8	79.0	89	68	84	74	82.0	82.2	0.69	17.5	0.24	10	6		3		245.05	8.45	70
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	73.0	61.6	67.3	77	59	69	63	71.7	71.5	6.39	162.3	1.69	14	12	1	18		152.60	5.26	44
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	74.4	54.1	64.3	77	44	71	60	69.6	69.2	5.30	134.6	1.96	11	10				187.55	6.47	54
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	73.9	58.3	66.1	78	56	69	61			5.52	140.2	2.40	11	10				201.55	6.95	58



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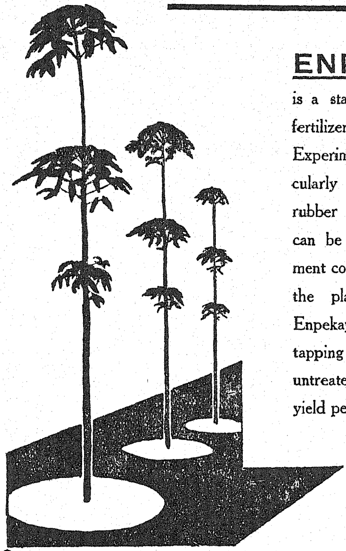

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Malayan Agricultural Journal.

MAY, 1936.

EDITORIAL.

Poultry Feeding.

An account is given in this number of experimental work which has been conducted at the School of Agriculture, Malaya, at Serdang, on the feeding of young chicks. We believe these experiments to be the first of their kind to be carried out in Malaya, and they thus mark a new and interesting departure in this field of investigation, besides providing a valuable contribution to our knowledge of this subject.

It is to be noted that the work was carried out in conjunction with training in general agriculture. Facilities for the conduct of research work are frequently provided in scholastic institutions and are of considerable value in that they impress upon students the necessity of careful observation and recording. In the present instance, the conduct of poultry investigations at the School of Agriculture carries with it the additional advantage of emphasising the scope which exists in Malaya for the extension of poultry husbandry to bridge the gap of about one million dollars annually between local production and the total consumption of poultry and eggs.

We have known a number of poultry-breeders in this country in the past who have relied almost entirely on imported poultry-food mixtures, and who claimed that their birds thrived on such foods. Foods mixed by commercial firms of repute are based on a knowledge of the nutritional requirements of poultry, and although the cost of imported foods in Malaya is high, they may be expected to possess advantages over many of the locally-devised rations, which not infrequently are ill-balanced in one respect or another. It is in respect of this matter of costs relative to efficiency that carefully-planned investigations with local rations assume a considerable degree of importance.

The experiments here recorded indicate that weight increase in young chicks can be considerably accelerated and made to approximate more closely to typical breed weights than was the case with rations previously advocated by this Department.

The author commences with a standard of weight increase of Rhode Island Reds from hatching to twelve weeks of age, which is accepted by poultry-breeders in temperate climates. As it was found impossible to attain this standard in Malaya with the rations usually adopted in the past, four new rations were drawn up and tested on chicks of this breed.

Too great reliance cannot be placed on the results of feeding with Ration C, as only one group of Rhode Islands was fed on this ration; Ration B gave better results than A, while Ration D was better than either A or B.

The fact that this work was conducted in conjunction with the school training prevented different batches of chicks being subjected to the experimental conditions simultaneously, and, therefore, rigid proof is not forthcoming. The probability is, however, that the results will be found to hold good in general practice.

The results indicate the desirability of including a comparatively high proportion of dried skim milk in the ration, and thus confirm, under Malayan conditions, results which have been obtained elsewhere. The author estimates that the cost of feeding a bird to 16 weeks, by which time it should weigh 3 lbs., would be about 80 cents. This may appear high, but it is cheaper than importing new pure-bred birds from abroad, and the quality of any surplus birds which were used for table purposes would be far superior to that of village-produced birds bought in the local markets.

The experiments were concerned only with the first twelve weeks of the life of the bird; the next step would appear to be to investigate rations suitable for poultry from this age until they come into lay or are ready for the table. It is to be hoped that, in spite of the limited facilities at the School, it may be found possible to pursue this subject in the near future.

Farm Schools.

In the last number of this Journal, an account was given of the annual prize distribution at the School of Agriculture, Malaya. In the course of his speech to the students, the Hon'ble Dr. H. A. Tempany, C.B.E., referred to "the coming into being of what may be termed the first child of the School in the shape of the Farm School at Malacca". He stated that it is hoped to open similar farm schools in Penang and Singapore and added:

> "If these ventures succeed, as I hope they will, there seems to be no reason why there should not ultimately arise a chain of Farm Schools extending throughout the Peninsula, with this institution (the School of Agriculture, Malaya) at the head of the chain."

In view of the development of farm schools throughout the country, visualized by Dr. Tempany, particular interest attaches to the article in this number dealing with the Farm School, Malacca. While it may be too early to gauge the ultimate effectiveness of the school, the venture appears distinctly promising as a means of stimulating rural life by improving the standard of agricultural practice amongst small-holders and in demonstrating in the most practical way the advantages of high-quality stock and improved planting material.

***Ustulina zonata* and Oil Palms.**

The fungus *Ustulina zonata* is well-known in Malaya and other tropical countries as a parasite capable of doing considerable damage to trees, *e.g.* rubber, tea, coffee.

This fungus has now made its appearance on the oil palm in Malaya and has been found on the roots, in association with a rotting of the roots and basal stem tissue, and on the stem, some feet above ground, causing a decay of the leaf bases left on the stem pruning.

In an article to be found on another page of this issue an account is given of the appearance of this fungus on the leaf base of a pruned oil palm leaf. Only one case of upper leaf base decay has so far been found, and in this instance the fungus had not penetrated into the stem tissue, so it cannot yet be stated that *U. zonata* actually can cause a form of stem rot of oil palms but, in view of the known parasitic nature of the fungus, it is not improbable that it may at any time in the future be recorded as capable of attacking the stem tissue above ground.

It is probable, however, that if this should occur the development of the fungus within the stem tissue would be slow and control measures should not be difficult.

Original Articles.

THE FOOD REQUIREMENTS OF YOUNG CHICKS

BY

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Introduction.

Profitable poultry farming depends largely on the successful raising of young stock. The economic life of a hen seldom exceeds two years after coming into lay, and may be considerably less, for egg production usually declines by then to a level which is unremunerative unless the eggs are of special value for breeding purposes. The periodical replacement with young pullets of a proportion of laying hens must therefore be accepted as an essential part of sound poultry management; and, whether it is the farmer himself or a specialist who carries out the actual operations of hatching and weaning, poor growth in the early stages will have serious consequences. Not only will pullets in general fail to attain typical breed weight by the time they reach sexual maturity—resulting in small eggs, a more or less rapid decline in the intensity of laying once the first flush is over, and possibly also in heavy mortality through inability to stand up to the physical strain of laying, if the birds arrive at that stage—but surplus cockerels will take longer to reach a marketable weight, and the cost of housing and feeding them for a prolonged period may be prohibitive. The growth rate of young chicks thus provides a subject for careful observation; and, where unsatisfactory progress is recorded, investigations should be undertaken without delay to ascertain and, if possible, remove the limiting factor or factors which are in operation.

One should not necessarily begin, however, by assuming that it is the ration or the system of feeding which is at fault, for a number of factors may adversely influence the digestion and assimilation of food. Weak fertilization, faulty hatching or incubation, internal or external parasites, and particularly chills, resulting from exposure to draughts or damp, are the most likely sources of trouble in this country other than the food supply. The poultry farmer should first satisfy himself that they are not responsible before proceeding to blame the ration.

Local Growth Rate.

The author's interest was first attracted to this subject by the consistently poor growth rate of young chicks at the School of Agriculture, Serdang, where a few small flocks have been maintained for some time, mainly for instructional purposes. Systematic weight records were not kept at the School before February 1935, but groups of chicks had been weighed occasionally to obtain a rough idea of their progress, and even from these records it was obvious that matters were by no means satisfactory. Since then, average weights have been recorded weekly

for each group from the date of hatching up to the age of 12 weeks, even where two or more groups of the same age were run together for convenience in management. The majority of birds so handled have been pure-bred Rhode Island Reds, and the figures given in this article consequently refer mainly to this breed. Poor growth, however, has by no means been confined to Rhode Islands, but has been just as evident with Light Sussex and with various cross-bred and half-bred chicks.

It is not possible to lay down absolute standards of weight increase, but some idea of what Rhode Island chicks should weigh at ages up to 12 weeks can be gained from Table I. The figures are based on those given in Card and Henderson's text-book. (1).

Table I.
Average Weights of Pure-Bred R.I.R. Chicks.

Age	Weight	Age	Weight
0 weeks	1.3 ozs.	7 weeks	15.5 ozs.
1 ,,	1.8 ,,	8 ,,	19.7 ,,
2 ,,	2.6 ,,	9 ,,	25.0 ,,
3 ,,	4.0 ,,	10 ,,	30.2 ,,
4 ,,	5.8 ,,	11 ,,	34.0 ,,
5 ,,	8.5 ,,	12 ,,	36.7 ,,
6 ,,	11.8 ,,		

It will be observed that, according to these figures, Rhode Islands may be expected to reach an average weight of about 2¼ lbs. by the age of 12 weeks, and that the rate of growth, as indicated by weekly increments in weight, gradually increases from birth to a maximum at about the 9th or 10th week and subsequently declines somewhat. One must be careful, however, not to regard these averages as an invariable criterion of good progress. They refer to chicks raised under temperate, not tropical, conditions; little information is available as to the precise methods by which they were obtained, save that they represent observations from several farms over a period of three years and "indicate what may reasonably be expected under favourable conditions of feeding and management". There is no evidence, for example, as to whether the chicks were weighed with a full or an empty crop or whether, and if so to what extent, the young chicks were culled. For the purpose of investigations at the School, the practice has always been to weigh with the crop empty and to carry out no culling during the experimental period beyond what has been inevitable through malformation at birth or death within the first 12 weeks. Records obtained from a number of chicks shew that the average difference between a full and an empty crop at 12 weeks of age is

about $1\frac{1}{4}$ ozs., or nearly 5 per cent. of the desired body weight; while, with a group of 31 R.I.R chicks of that age averaging 31.5 ozs. in weight, individual weights ranged from 23.5 to 42 ozs. and—by culling to the extent of 20 per cent. by destroying the six lightest birds—the average weight would automatically have been raised to 35 ozs. Evidence is also forthcoming that, with certain animals at least, a strain that has been raised of European parents in the tropics is usually somewhat lighter than its temperate relations. It is therefore not unreasonable to assert that, so far as actual records are concerned, conditions at the School are not conducive to high figures; and, therefore, while it was hoped in the beginning to obtain weights which would at least equal those cited by Card and Henderson, it was felt that an average of not less than 32 ozs. at 12 weeks of age should be regarded as satisfactory.

Throughout the twelve months covered by these investigations, chicks have been hatched and reared both by the natural method and by a Hearson's incubator (50 egg size) followed by various types of outdoor brooder. The Rhode Island parent stock, which was imported from England as young birds in December 1933, has remained in reasonably good condition ever since, but the first generation offspring compares unfavourably in body weight and egg size, presumably as a result of failing to make satisfactory progress as chicks. No serious fault has been found with the management of hatching and weaning operations. With the exception of a few casualties, which may be regarded as more or less inevitable with young birds, the chicks have appeared to be reasonably healthy, both appetite and activity being good, and the records of chicks raised under broody hens have shewn no consistent differences from those raised artificially.

To begin with, a number of autopsies were conducted on 7-day-old chicks. These shewed that the yolk was completely absorbed by that time—in other words, that digestion was functioning normally immediately before and after birth. Enquiries at a number of sources throughout the country then elicited the information that poor growth rate was the rule rather than the exception, at any rate where chicks were raised intensively or semi-intensively; and that, wherever efforts were being made to feed scientifically balanced rations, the ingredients were more or less the same as those then in use at the School, but with small differences here and there in the proportions of the mixture. Again, when judging locally-bred fowls at the Malayan Exhibition in August, 1935, the author was impressed by the lack of weight in many of the exhibits, particularly the pullets. Few satisfactory claims have been received, in fact, and these have seldom been supported by actual figures. Two reports, however, are worthy of note in this place: one, that chicks hatched from eggs supplied by the School and fed on an imported chick meal supplemented by finely chopped boiled eggs reached an

average weight of 8 ozs. at 4 weeks and 19 ozs. at 8 weeks—the other, that chicks raised on Ration B (*vide infra*) but allowed free range almost from birth weighed nearly 6 ozs. at 3 weeks and 10 ozs. at 5 weeks of age.

Nutritional Value of Rations.

From the above considerations, it was concluded that the problem was essentially one of nutrition. Chicks at the School, and frequently elsewhere, can be allowed only limited range; and, even when free range is available, its value as providing access to a natural source of food such as seeds and insects probably varies between wide limits depending on soil texture and nature of cultivation. There is consequently a risk, even with free range, that chicks may pick up little in the way of "free" food and thus be largely dependent on artificial supplies.

Bearing in mind not only the above but also the fact that cereals and their by-products usually constitute from 50 to 75 per cent. of typical chick rations, the objective at the School has always been to devise a balanced ration suitable either for intensive or semi-intensive systems of management or as a supplementary ration where the extensive system is adopted, and composed as far as possible of locally grown or locally manufactured ingredients. Thus, the only cereals employed are padi and maize; but, in the absence of locally prepared white fish meal of first class quality, these cereals have had to be supplemented by imported animal proteins and, in the earlier experiments, by imported minerals as well.

Prior to February 1935, the food supply consisted of Ration A (*vide infra*), (2), together with succulent greenstuff such as fresh lettuce and *kangkong* leaves and fresh cows' milk which was first skimmed and diluted with an equal volume of water and then fed in the drinking vessels. The mash was soon changed to that of Ration B for reasons which have been indicated elsewhere (3), the main object being to secure a balance between proteins and carbohydrates more in accordance with standards advocated by Halnan (4) and other authorities; but the feeding of good greenstuff and liquid milk was continued.

The composition of Rations A and B is shewn in Table II, while Table III gives the corresponding average weights of chicks up to 12 weeks of age, by which time the young birds have been completely weaned from chick to "growers" rations. This weaning process at the School follows that which is commonly practised in England and other temperate countries, young birds receiving chick rations alone for the first 8 weeks of life, after which the change to the growers ration is effected gradually by feeding 3 parts of chick to 1 part of growers mash during the 9th week, equal parts of each during the 10th week, 1 part of chick to 3 parts of growers mash during the 11th week, and subsequently growers rations only until the pullets are approaching sexual maturity, when layers rations are introduced gradually in the same way. The same growers mash was employed

throughout these investigations; and, although it may be capable of improvement, indications at present are that it fulfils requirements reasonably well. Results obtained with the various chick rations which have been tested might have been discontinued at the end of the 8th week, but it was considered preferable to continue them up to the 12th week, by which time the use of chick mash had entirely ceased.

Table II.

Composition of Dry-Mash. Rations A and B.

(Parts by Weight).

Ingredients.	Ration A	Ration B
Padi, ground, husk discarded ...	11	40
Maize, yellow, ground ...	—	12
Bran, white cargo ...	—	20
Groundnut cake ...	4	11
Whale meat meal ...	4	12
Steamed bone flour ...	0.36	$2\frac{1}{2}$
Powdered limestone ...	0.12	$1\frac{3}{4}$
Salt ...	0.12	$\frac{5}{8}$
Ferric oxide ...	—	$\frac{1}{8}$
Red palm oil ...	0.4	—
Supplying approximately ...	21.5 per cent.* D.P. and 78.0 per cent. S.E.	14.3 per cent. D.P. and 65 per cent. S.E.

* D.P. = Digestible Protein. S.E. = Starch Equivalent. (3)

The figures given in Table III are in each case the average weights of three groups, comprising a total of 14 chicks receiving Ration A and 22 chicks receiving Ration B. They indicate that the revised ration failed to effect any improvement in growth during the first 8 weeks of life, but that somewhat better progress was subsequently recorded by chicks raised on Ration B. Thus, at 12 weeks of age, this ration gave an average of 20.7 ozs. with Rhode Islands as against only 14.1 ozs. with Ration A.

If a typical Rhode Island chicken should weigh 2 to $2\frac{1}{4}$ lbs. at 12 weeks of age, 14 ozs. and 20 ozs. must be regarded as almost equally unsatisfactory. Opportunity was therefore taken of discussing the problem with Professor J. L. Rosedale of the College of Medicine, Singapore, and of surveying some of the available literature on the subject (5) to (10), in the light of which both rations

Table III.

Average Weight of R. I. R. Chicks fed on Rations A and B.

Age	Normal Averages	Actual Averages at Serdang	
		Ration A	Ration B
0 weeks	1.3 ozs.	—	1.3 ozs.
1 „	1.8 „	—	1.6 „
2 „	2.6 „	2.6 ozs. *	2.2 „
3 „	4.0 „	—	2.7 „
4 „	5.8 „	—	3.1 „
5 „	8.5 „	—	4.3 „
6 „	11.8 „	5.5 ozs. *	5.5 „
7 „	15.5 „	6.8 „ *	7.0 „
8 „	19.7 „	—	9.3 „
9 „	25.0 „	9.3 „	11.5 „
10 „	30.2 „	10.5 „	15.0 „
11 „	34.0 „	11.9 „	18.0 „
12 „	36.7 „	14.1 „	20.7 „

* = records prior to February, 1935.

were re-examined in detail under three main headings—proteins, minerals and vitamins.

In relation to the first of these, the main questions which arose were (i) the biological value of the proteins of these rations, (ii) the optimum proportion of good protein in a chick mash. Cereal proteins, especially those of rice, are poor both in quantity and quality, while those of animal and vegetable concentrates vary considerably. A mixture of concentrates should always be employed; but, whereas whale meat meal in combination with groundnut cake is satisfactory for laying hens, a wider variety is possibly needed for young chicks where growth is the primary objective. Analyses of whale meat meal and groundnut cake indicate that they are not deficient in the important amino-acids lysine and tryptophane, but other factors are almost certainly involved, the precise nature of which is not yet fully understood. One fact, however, is certain—that milk, and particularly dried skim milk, is one of if not the most efficient source of protein for young

animals in general. Reliable chick mashes in the British Isles usually contain up to 10 per cent. of dried milk unless the chicks can be given separated milk *ad lib.*.

It was found at the School that chicks consumed very little liquid milk, either in the fresh condition or when artificially soured by the addition of rennet. Moreover, the labour required for cleaning drinking vessels used for milk presented difficulties. It was therefore decided to substitute dried skim milk for at least part of the existing protein-rich ingredients and to discontinue the feeding of liquid milk. By using a modest proportion of skim milk in the first place, it was anticipated that any serious deficiencies in the biological value of whale meat and groundnut cake proteins would be exposed.

Opinion seems to be divided as to the optimum proportion of good protein in a chick mash, some authorities recommending about 14 per cent. while others recommend as much as 18 per cent. It was therefore considered advisable not only to introduce skim milk but also to test the effect of increasing the protein content of the ration.

In relation to minerals, no deficiency was apparent in chicks raised on Rations A and B, where the size and shape of frame—as distinct from its weight—and the strength of the bones was satisfactory. Some variation must be expected even with good rations, and undersized birds are usually rigorously culled in commercial practice as soon as they are detected. Moreover, as dried skim milk is comparatively rich in calcium, there appeared to be little if any risk in substituting this for part of the whale meat meal.

The vitamin aspect of the problem was made clearer by reference to the work of Plimmer and his associates, as set forth in *The Biochemical Journal,* and that of Rosedale in this country. Thus, while 0.5 per cent. cod liver oil (or its equivalent) may be accepted as the minimum requirement of fowls for vitamin A, 2 per cent. appears to be the optimum proportion. Reference to Rosedale's figures (11) shews that 1 gram of yellow maize supplies only 6 vitamin A units as against 1,300 units per gram for cod liver oil and 1,200 for unbleached palm oil. In other words, a ration composed entirely of maize would just supply the minimal quantity of vitamin A; but such a diet would, of course, be completely unbalanced in every other respect. To make certain that the requirements for vitamin A are fully satisfied, it is therefore considered desirable that 2 to 3 per cent. red palm oil should be included in all balanced poultry rations in this country, at any rate where free range is not available. No evidence of vitamin A deficiency has actually been observed in young chicks raised exclusively at the School, even on Ration B; but it must be admitted that deficiency diseases may not manifest themselves for some considerable time and may even pass unnoticed when such matters as size of egg, fertility and hatchability are at stake.

Vitamin B_1 was supplied in both Rations A and B by the ground padi and also, in the latter case only, by the white cargo bran (*not* parboiled bran which,

owing to its method of manufacture, has lost most of its water-soluble vitamins). Uncertainty was, however, felt in relation to the vitamin B_2 complex, which plays an important part in growth. The main source of this had been "good" greenstuff; but the vitamin B_2 content of greenstuff is extremely variable, and even *kangkong* and lettuce alone might fail to supply enough for a rapidly growing chick. Rosedale's figures (11) now enable one to check the vitamin B content of a ration with fair accuracy so far as those ingredients are concerned which are employed in the diet of human beings. Thus, if yeast is regarded as having a vitamin B value of 100, the requirements of adult chickens are estimated to have a value of 6, while those of young chicks require somewhat more (8 to 10) to balance the increased proportion of proteins. On this basis, Rations A and B appear to have a value of about 5 and 9 respectively. It was anticipated that dried skim milk would help to remedy any deficiency that may have existed, but that recourse to further supplies might prove to be advisable in the form of unextracted dried yeast (*not* extracted yeast, which has yielded up most of its vitamin B in the manufacture of preparations such as Marmite).

The conclusions drawn were thus that both Rations A and B were lacking in biologically good proteins, that Ration A was also deficient in vitamin B, and that Ration B was deficient in vitamin A. A series of feeding trials was therefore drawn up in which these factors could be examined first singly and then in combination. For the first of these trials, Ration C was devised. This was similar to Ration B but included 8 per cent. dried skim milk at the expense of bran, whale meat meal and groundnut cake which were reduced to 15, 10 and 10 per cent. respectively. This mash, with a slightly higher proportion of protein than that of Ration B, was fed *ad lib.* together with the usual allowance of good greenstuff but without liquid milk. The results obtained from three groups of chicks are recorded in Table IV, normal averages being repeated for comparison. The figures are interesting as they appear to demonstrate two facts:—

(*a*) the incorporation of only 8 per cent. dried skim milk in the ration, with a slight reduction in the whale meat meal and groundnut cake and the exclusion of liquid milk, effected no improvement in growth rate during the first 6 or 7 weeks;

(*b*) chicks fed on this mash then shewed a sudden and conspicuous improvement, so that—although subsequent progress did not altogether come up to expectations—they definitely weighed more than chicks raised on Rations A or B.

On examining the subsequent history of those chickens which had received Rations A and B, indications were observed that there was frequently, but not invariably, a pronounced increase in weight at one stage or another. With Ration A, this jump took place—when it did occur—during the fifth month, while with Ration B it tended to occur somewhat earlier. Ration C produced an appreciable jump in three successive tests at a much earlier age, about the seventh week. It is interesting to note that a similar jump was experienced in the original records

Table IV.

Average Weights of Chicks fed on Ration C.

Age	Normal Averages	Actual Averages at Serdang		
		Lt. Sussex x R.I.R. (12 chicks)	R.I.R. (5 chicks)	R.I.R. x Native (8 chicks)
0 weeks	1.3 ozs.	1.3 ozs.	1.4 ozs.	1.1 ozs.
1 „	1.8 „	1.6 „	1.6 „	1.2 „
2 „	2.6 „	2.1 „	2.1 „	1.6 „
3 „	4.0 „	3.1 „	2.9 „	2.6 „
4 „	5.8 „	3.7 „	3.9 „	3.1 „
5 „	8.5 „	4.7 „	5.5 „	4.0 „
6 „	11.8 „	5.9 „	7.6 „	5.5 „
7 „	15.5 „	8.8 „	10.5 „	10.0 „
8 „	19.7 „	11.8 „	12.7 „	11.0 „
9 „	25.0 „	14.7 „	16.7 „	13.0 „
10 „	30.2 „	17.8 „	18.3 „	16.0 „
11 „	34.0 „	20.2 „	22.3 „	22.0 „
12 „	36.7 „	23.0 „	26.6 „	25.0 „

of Plimmer and Rosedale (5), and it is probably a by no means unusual occurrence in young animals generally, although the precise reasons for it are not clear. So far as chickens are concerned, however, it is desirable that—if such jumps must occur—they should do so as early as possible, particularly where table birds are concerned—but that they should not be too pronounced as they might encourage the development of leg weakness if bone formation failed to make equal progress.

The fact remains that the inclusion in the mash of only 8 per cent. dried skim milk had effected no material improvement during the first 6 weeks and had subsequently not led to the attainment of normal weights, although some advance had been made in this direction as is seen by comparing weights at 12 weeks of age. The next step in the investigation appeared to lie in increasing the proportion of dried skim milk.

Experimental Rations.

By this time, however, the problem assumed a much greater degree of local importance. Reports of poor growth were constantly being received, while the demand for good stock and for reliable advice on feeding had expanded considerably. It would have been preferable to have been able to continue the original policy of examining the effect of each factor separately before testing

them in combination; but, with the limited facilities for such work which are at present available at the School, a considerable time would have elapsed before final conclusions could be drawn. It therefore seemed advisable to change the earlier procedure and, in the light of experience, to aim at devising a mash which would satisfy all the known or anticipated requirements. Provided that such a mash gave satisfactory results, further experiments might subsequently be undertaken with a view to eliminating any superfluous ingredient. Ration D, containing not only a high proportion of dried skim milk but also dried yeast and palm oil, was therefore introduced about the end of September 1935. A proportion of whale meat meal was still retained in the ration in order to maintain a narrow protein ratio; but steamed bone flour, powdered limestone and iron oxide were omitted as the ration was considered to supply sufficient minerals without them.

RATION D.

		parts.
Padi, ground, husk discarded	...	20
Maize, yellow, ground	...	20
Bran, white cargo	...	24
Dried skim milk	...	20
Whale meat meal	...	10
Yeast, dried, unextracted	...	3
Salt	...	1
Red palm oil	...	2
		100

(Supplying approximately 17.5 per cent. D.P. and 64.5 per cent. S.E.).

In addition to its high protein content, Ration D has a vitamin B value of 11 while the vitamin A content is equivalent to over 1.9 per cent. of cod liver oil.

The results obtained with this mash are shewn in Table V.

These records shew that progress was excellent for the first 6 to 7 weeks, but that increments then fell behind those recorded by Card and Henderson and left an average deficit at 12 weeks ranging from 5.7 ozs. (about 15 per cent.) in the case of Rhode Islands to 3.4 ozs. (about 10 per cent.) in the case of the R.I.R. x Native cross, where hybrid vigour appears to have played a considerable part. The figures for Light Sussex at 12 weeks of age should not be regarded as significantly better than those of Rhode Islands or cross-breds as only 5 birds were involved. In the case of the Rhode Islands it may be mentioned that one group of 5 chicks included in these figures, which had been hatched and raised under a broody hen, averaged only 25.3 ozs. at 12 weeks, as against 32.3 ozs., 30.7 ozs. and 31.5 ozs. respectively for the remaining three groups which were hatched and raised artificially.

As stated earlier, it is considered that weights over 32 ozs. at 12 weeks of age should be regarded as reasonably satisfactory. Had the group which averaged

Table V.
Average Weights of Chicks fed on Ration D.

Age	Normal Average	Actual Averages at Serdang.		
		R. I. R. (53 chicks)	Lt. Sussex (5 chicks)	R.I.R. x Native (37 chicks)
0 weeks	1.3 ozs.	1.4 ozs.	1.3 ozs.	1.2 ozs.
1 ,,	1.8 ,,	2.1 ,,	2.2 ,,	1.8 ,,
2 ,,	2.6 ,,	3.4 ,,	3.8 ,,	3.1 ,,
3 ,,	4.0 ,,	5.1 ,,	5.8 ,,	4.5 ,,
4 ,,	5.8 ,,	7.1 ,,	7.0 ,,	6.5 ,,
5 ,,	8.5 ,,	9.6 ,,	11.2 ,,	9.4 ,,
6 ,,	11.8 ,,	12.3 ,,	14.4 ,,	12.5 ,,
7 ,,	15.5 ,,	15.6 ,,	15.3 ,,	15.5 ,,
8 ,,	19.7 ,,	17.6 ,,	18.0 ,,	18.4 ,,
9 ,,	25.0 ,,	20.9 ,,	21.6 ,,	22.2 ,,
10 ,,	30.2 ,,	24.6 ,,	27.3 ,,	25.9 ,,
11 ,,	34.0 ,,	27.8 ,,	31.0 ,,	29.7 ,,
12 ,,	36.7 ,,	31.0 ,,	35.6 ,,	33.3 ,,

31.5 ozs. at 12 weeks been culled to the extent of 20 per cent. and weighed in the evening when the crop was full, the average would have been 36.7 ozs.—equal to that of Card and Henderson. At the same time, the fact that average weights were perfectly satisfactory up to the sixth or seventh week but than fell off suddenly appears to indicate that another factor may be involved. Two such factors have been suggested—minerals and climate. The first of these was tested by raising a few groups of chicks on a modified Ration D in which 2 per cent. powdered oyster shell was included at the expense of bran. The results obtained with a group of 13 Light Sussex chicks, for example, were 12.3 ozs. at 6 weeks, 15.1 ozs. at 7 weeks, 18.5 ozs. at 8 weeks, and 34.4 ozs. at 12 weeks of age, shewing the same falling off at about the same age, and from these figures it is concluded that the inclusion of additional calcium had no effect on growth rate. It may, however, be observed that Ration D contains only about 1.5 per cent. of calcium oxide, as against 2.5 per cent. when oyster shell was added, and that the latter figure is more in accordance with Halnan's recommendations. The extra minerals may therefore be advisable, but they cannot be definitely regarded as necessary. The only amendment to Ration D which is at present recommended is to increase the palm oil to 3 per cent., thus making quite certain that vitamin A is fully supplied.

The Climatic Factor.

The possibility of a climatic factor has not yet been fully investigated. It appears possible that in the tropics, where development in certain physical respects is commonly earlier than in the temperate zones, the necessity for a high protein content in the ration does not extend over the whole of the period covered by these investigations, and it may be desirable to wean young chicks from chick mash somewhat earlier than has been the practice at the School. It is therefore proposed to test the effect of starting weaning before the ninth week. The results of these further investigations will be published in due course.

Economics.

In conclusion, a few remarks on certain economic aspects of the subject may not be out of place. Excluding transport charges from local dealers and the cost of labour for grinding and mixing, the cost of Ration D at the School is 5.8 cents per lb., as against 3.6, 3.0 and 4.0 cents for Rations A, B and C respectively and 2.5 cents for growers mash. Provided that the major ingredients are purchased in lots of at least 1 cwt., the all-in cost of Ration D should not exceed 8 cents and growers mash 4 cents a lb., but these figures would be considerably higher if supplies were purchased in small quantities at a time.

It is estimated that a heavy breed chick consumes about 4 lbs. of food during the first 8 weeks of life, 4 lbs. during the next month, and 6 lbs. the following month. Excluding waste, the extent of which cannot be discussed in detail in this place but depends mainly on the type of mash trough and system of feeding employed (wet mash being more economical than dry where sparrows are numerous), it should not cost more than 32 cents to feed a chick up to the eighth week and 23 cents for the next month while changing over to growers mash, so long as chicks are raised on a farm scale. For mere backyard operations, however, these costs would be higher, as explained above. Under existing *kampong* conditions, rations such as these would be uneconomic; but, for chicks which will develop into good laying hens or breeding cockerels, the above estimate cannot be regarded as high in Malaya, where imported rations are even more expensive. For the farm scale production of table birds, feeding costs to 16 weeks of age would be about 80 cents and the birds should then average about 3 lbs. each. Such fowls might not compete directly with *kampong* table birds in the ordinary local markets, where there are usually ample supplies of table birds scaling 2½ to 3 lbs. live weight and selling at 50 to 60 cents each; but the quality of market fowls at this price leaves much to be desired, particularly in respect of tenderness, succulence and proportion of meat to bone, and it is by no means impossible that table birds raised on a milk-rich diet such as Ration D would soon command a special market of their own, with correspondingly high prices, as in fact already occurs with local capons. Under backyard conditions, a 16 weeks bird would probably cost the owner $1.50 in food, if fed on these rations alone, but this could be considerably reduced by the use of household scraps after the weaning stage

If large scale poultry farmers existed in this country, they would naturally purchase foodstuffs in bulk, either buying each ingredient separately in the cheapest available market and carrying out grinding and mixing operations with their own labour, or purchasing mixed rations (if available at reasonable prices) in quantities which could be stored for a convenient length of time, which would depend upon the risk of deterioration. Ground cereals rapidly become infested with pests in this country unless they are stored carefully in a dry place. For the purchaser of small quantities of say 7 or 14 lbs. at a time, it should be possible to market a mash in sealed air-tight tins thereby avoiding not only damp but the possibility of adulteration. In this form, a 7 lb. tin of Ration D could probably be retailed at about $1.00. A useful alternative for both small and bulk supplies would lie in marketing the mash without its cereals and bran in the form of a "concentrate" to which the poultry keeper would add ground padi and bran, with or without maize, in accordance with instructions supplied with the container. Marketed in either of these forms, Ration D should overcome the legal difficulties which at present restrict the sale of dried skim milk in this country, and should go far towards solving what is at present a serious problem in the improvement of the existing standard of poultry husbandry.

Summary.

Attention is drawn to the unsatisfactory growth of young chicks which is commonly experienced in Malaya.

The average weights of young chicks from birth to 12 weeks of age, fed on four different rations, are recorded and compared. They indicate that a comparatively high proportion of milk in the ration is desirable if satisfactory growth is to be secured. Thus, a ration containing 20 per cent. dried skim milk gave average weights with Rhode Island Reds of 31.0 ozs. at 12 weeks, as compared with 14.1, 20.7 and 26.6 ozs. for other rations and an expectation of 36.7 ozs. in a temperate climate.

Average weights at the School could be raised to normal if chicks were culled more rigorously and if they were weighed with a full crop. There is, however, evidence that some other factor, so far undetermined but possibly climatic, is involved.

Acknowledgments.

The author wishes to express his indebtedness to Professor Rosedale for his kindly interest and help. He also has to acknowledge the assistance rendered in these investigations by those members of his staff and students who have been responsible for preparing and feeding the rations and for recording the figures on which this article is based.

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USTULINA ZONATA ON THE OIL PALM

BY

A. Thompson,

Mycologist.

Ustulina on the Roots.

In 1933 a disease affecting the roots and the internal tissue at the base of the stem of oil palms was recorded from two localities in the Federated Malay States.

On one estate, on a lateritic soil, the base of the stems of some four-year old palms was found to be decayed internally with a black, dry rot which gave a charred appearance to the tissue, and had extended up the stem for not more than 18 inches. Many of the roots at the base were disintegrated, and since the lower leaf bases *i.e.* portions of the leaf stalks which remain attached to the stem when the leaves are pruned, were healthy it was considered that the rot had probably entered originally *via* the roots. A fungus was obtained in culture from the margin of the decay in the stem, but no spores or fructification developed and this fungus has not been identified. An orange-yellow pigment appeared in the medium when the fungus was grown on maize-meal agar.

The older leaves of these palms were affected by an abnormal yellowing and withering and it was observed that the majority, but not all, of the palms so affected were those whose growth had clearly been less vigorous than that of their neighbours. The disease was not confined to any one situation, and its incidence bore no apparent relation to local variations in soil type, neither was there any evidence of the presence of a hard pan.

This disease has been referred to as "Charcoal base-rot". (1)

From another estate in the same year a specimen of decayed basal stem tissue of a young oil palm was received. The charred appearance of the tissue suggested that the above-mentioned disease was present.

In 1934 a report was received from this estate that a palm exhibiting base rot had fallen over and the opportunity was taken to examine the palm *in situ*.

The palm was approximately four years old; the lower leaves had turned yellow, but otherwise growth appeared to have been normally vigorous.

The leaf-bases were sound but the bole of the palm below ground was decayed on one side with a greyish-brown, rather dry rot, and all the lower roots on this side were similarly affected. The rot had extended slightly up the centre of the stem, and about a quarter of an inch behind the margin of this rot there was a black, irregular line. In the case of the more recently formed roots situated near the margin of the decay, just below soil level, the decay was extending outwards into some of the roots.

No fungus fructifications were found on the palm, and cultures set up from the margin of the decayed tissue in the stem produced nothing but saprophytic moulds. Cultures taken from the margin of the decay in the roots, into which

the rot had extended outwards, produced mycelial growth similar to the growth obtained in culture from isolations taken from rubber wood attacked by *Ustulina zonata*.

The palm had been planted in close proximity to a buttressed jungle stump on which, however, no signs of Ustulina were detected. Adjacent palms were inspected but were found to be healthy, and no further cases of this root disease have since been reported. The charred or ''charcoal'' appearance of the tissue observed in 1933 was not prominent in this instance which possibly represented an earlier stage of ''Charcoal base-rot'' in which blackening of the affected tissue had not yet occurred.

Ustulina on the Stem.

When the leaves of an oil palm are pruned the leaf bases may harden and remain attached to the stem for many years, or they may begin to decay mainly as a result of the growth of fungi within the tissue. The fungi enter *via* the sloped pruning cut or through other wounds, and according to the nature of the fungus, weather conditions, the vigour of the palm, and the presence of termites, weevils or other insects, decay may extend as far as the stem or into the stem, or may extend only a short distance into the leaf base tissue.

Up to the present, in Malaya, only two fungi have been found capable of penetrating from the decaying leaf bases into the stem tissue of oil palms and to cause a disintegration of the stem, resulting in the death of a palm (1) and (2). These fungi are *Fomes noxius* (which also causes ''brown-root'' disease of the rubber tree, tea and coffee), and *Ganoderma lucidum* which sometimes attacks the roots of backward coconut palms.

In February 1936, while inspecting some palms on the estate where Ustulina had formerly been recorded on the roots of a palm, an unusual type of leaf base decay, which had not penetrated into the stem tissue, was observed on one palm at about 5 feet from the ground. *Ustulina zonata* was identified as the cause of the decay.

Symptoms.—The palm on which the fungus was recorded was approximately 7 years old, growing on the slope of a hill in an undulating area of quartzite soil. The stem was well-developed and the leaves were of a good green colour. Many of the old leaf bases were in varying stages of decay chiefly as a result of the growth of the fungus *Poria Ravenalae*—a saprophyte—within the tissue. On the side of the palm facing north-east, however, an unusual type of decay involving ten leaf bases was observed. On cutting through one of these leaf bases the tissue was found to be rather dry, tindery, dull tawny olive in colour and was permeated at the bottom with black lines which surrounded ''islands'' of tissue of a lighter colour (in some cases of a darker colour), than the remainder of the tissue.

The affected leaf bases were in contact with each other, and when they were all cut away down to the junction with the stem, a decayed patch about two feet square was exposed. The colour of the decayed tissue was similar to the decay

in the leaf bases and the black lines were prominent. The stem tissue above and below the decayed patch was healthy.

The Fungus.—Fructifications of *Ustulina zonata* were present in the perithecial stage on four of the decayed leaf bases. (See illustration). The conidial stage of the fungus was not found on the leaf bases; this is the first stage formed on the fructification which appears on the surface of diseased material in the form of a yellowish-white soft plate turning to greyish-white when about 1½ or 2 inches in diameter; it is about 1/10th inch thick. When the conidia, or first spores, are formed on the surface, the plate darkens to a greenish-grey colour. Later, furrows, more or less concentrically arranged, develop, the colour darkens to purple grey, and the plate becomes leathery in consistency, and dotted with numerous tiny black spots. These spots are the openings of the perithecia (sac-like structures embedded in the tissue of the plate in which the second spore form—the ascospores —are produced). Finally the fructification becomes black and brittle and by this time a number of plates may have fused together forming a large irregular plate.

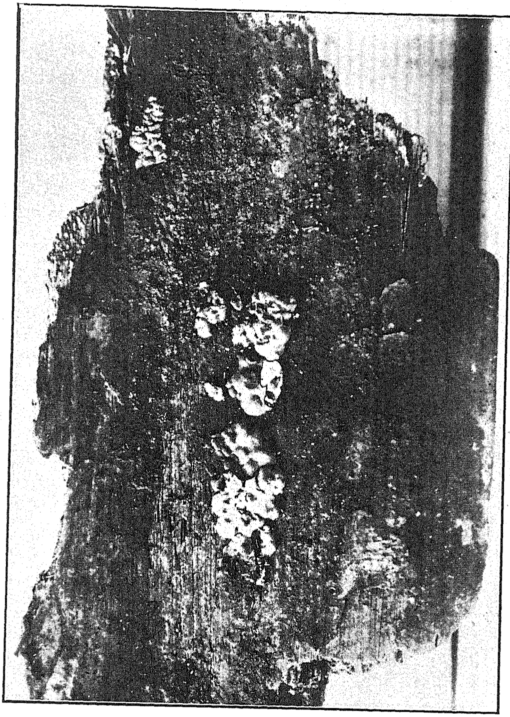
[It should be mentioned here that the fungus *Poria Ravenalae,* which is harmless, is perhaps the commonest fungus on oil palm leaf bases. It also forms a greyish plate on the surface of the leaf bases but it can be distinguished from *Ustulina zonata,* easily, on examination.

Poria Ravenalae grows as a very thin, unfurrowed, grey skin which can be scraped away, and the surface is composed of minute pores which cannot be seen distinctly with the naked eye. *U. zonata* is much thicker, and its surface is furrowed and not porous.]

The Effect of the Fungus on the Stem.—The decay had not penetrated noticeably into the stem tissue, but apparently had stopped at the point where the leaf bases merged with the stem. The fungus appeared to have entered through one or two of the leaf bases and to have extended laterally, on reaching the stem tissue, into the adjoining leaf bases and then extended upwards and outwards in these leaf bases and formed fructifications instead of penetrating further into the stem.

Remarks.—This lateral extension has also been noticed in the case of stem rot caused by *Fomes noxius,* (which belongs to a different group of fungi) but *Fomes noxius,* as a rule, penetrates into the stem tissue for a short distance (about ½ inch) and then extends laterally, in the outer stem tissue as well as outwards in the adjacent leaf bases, before penetrating deeper into the stem, and fructifications are not formed until inward penetration is well advanced.

In view of the fact that, although considerable lateral extension of *U. zonata* had occurred in the tissue at the stem, no penetration of the stem was observed, it is possible that Ustulina may not function as a stem parasite of the oil palm, and it may be found that on the stems it is no more dangerous a fungus than *Poria Ravenalae*. *Ustulina zonata,* however, is a parasite of rubber, tea, coffee and other trees, and if not checked on these hosts it can extend in a plantation and do considerable damage, and the fact that it has now been recorded in



Fructifications of *Ustulina zonata* on a Leaf Base of an Oil Palm

association with a root disease and as a potential wound parasite of the stems of oil palms merits attention although, as yet, evidence of actual penetration into the stem tissue, *via* the leaf bases above ground, is lacking.

It would be unwise to draw conclusions from this isolated instance, until the parasitic possibilities of the fungus are tested further on the oil palm.

Pure cultures of the fungus have been prepared from material collected from the affected palm, and the fact that the mycelium in the tissue at the stem was alive has been determined by the isolation of the fungus from the tissue at this point. It is intended to carry out inoculation experiments with these cultures and with spores from fructifications, but if the fungus grows slowly in the non-woody tissue of the oil palm these experiments may be inconclusive.

It is hoped, therefore, that managers of oil palm estates will communicate with the writer if they observe the fungus on the roots or stems of oil palms on their estates, so that information as to its status as a parasite can be collected more rapidly.

With regard to Ustulina on the roots of oil palms, the evidence obtained to date indicates that, under certain conditions, the fungus is probably a parasite of the roots of the oil palm, but until further cases have been observed it is not possible to make a definite statement on this point.

Portions of a palm suffering from root disease, and from which Ustulina was isolated, were buried in close contact with the roots and base of the stem of a healthy oil palm but the inoculating material decayed away and the healthy palm did not become infected. Despite this single negative result, however, it would appear to be unwise to dispose of palm tissue, affected by Ustulina, by burying it in an oil palm area. [In the case of palms affected with stem-rot caused by *Fomes noxius,* burying the dead palms *in situ* disposes of the risk of spore infection from fructifications produced on the stem, and up to the present no cases of root disease have occurred as a result of this practice.]

Until more is known about the conditions likely to favour root or stem infection of oil palms by Ustulina, disposal, by burning, of leaf bases or tissue attacked by Ustulina is recommended in place of burying. Burning should be as complete as possible so as to prevent the formation of fructifications.

Summary.

1. A disease of oil palms affecting the roots and basal stem tissue, and referred to as "Charcoal base-rot", is described.
2. The association of the fungus *Ustulina zonata* with a somewhat similar disease is recorded.
3. A case of leaf base decay of an oil palm, caused by *Ustulina zonata,* is reported, and, although the stem tissue was not affected, it is considered desirable to investigate further the parasitic status of Ustulina on oil palms, in view of its known parasitic habit on other hosts.
4. The potential danger of burying diseased material affected by Ustulina is indicated.

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THE FARM SCHOOL, MALACCA

BY

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Agricultural Officer, Malacca.

The proposal to institute, in Malacca, a system of vocational training in agriculture through the medium of a Farm School was submitted to Government, by the Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States, early in 1934. The original idea, which emanated from the Inspector of Schools, Malacca, was for a combined Technical and Agricultural School in Malacca town.

In forwarding his proposals, including the scheme for the Farm School, the Director mentioned that the School would in no way constitute a replacement of the facilities already in existence at the School of Agriculture, Malaya, by virtue of the fact that the instruction to be provided in Malacca would be of a more elementary nature as compared with that conveyed in the courses at Serdang, while, in addition, the cost of maintaining pupils at Serdang and the fact that the total accommodation there was limited to 80 pupils, restricted the capacity of that institution to deal with the problem of agricultural education in Malaya as a whole.

It was also mentioned that the project constituted a further step in the general policy of agricultural development as outlined in the Re-organization Proposals for the Department of Agriculture, prepared in 1930.

The proposals received the favourable consideration of Government and funds were made available, early in 1935, for the provision of the necessary buildings and equipment for the School. Work on the erection of the buildings commenced about the middle of the year and was completed in time to allow of the opening of the School on the 2nd September, 1935.

Objects of the School.

The major object of the School is the improvement of native agriculture in the Settlement. To this end, a course is provided which covers the principles and practice of agriculture, with special reference to local conditions, being designed primarily with a view to providing suitable training for boys whose future lies in the working of their own and their parents' holdings.

Situation.

The School is situated at the Sungei Udang Agricultural Station, some 13 miles from Malacca town, along the Mesjid Tanah road. The multiplicity of crops, both annual and perennial, under cultivation at this 23 acre Station, provide wide scope for practical instruction.

Buildings and Equipment.

The school buildings comprise quarters for the officer-in-charge, a class room, with a small room attached which can be used either as a mess-room or as an office, and bath and changing rooms. All are wooden structures of a semi-permanent nature. The class room is designed to provide accommodation for 25 pupils.

The equipment is of a simple nature and comprises desks, blackboards, a laboratory bench and cupboards. A certain amount of laboratory equipment is provided for the purpose of practical work of an elementary scientific nature, while the necessary tools for the carrying out of field work are also available.

Staff.

The School and the adjoining Agricultural Station are both under the charge of a Malay Instructor of the rank of Agricultural Assistant, Grade II, in the Department. The present Instructor is an officer whose previous experience includes four years service as a Junior Lecturer at the School of Agriculture, Malaya.

The School is under the direct control of the Agricultural Officer, Malacca, who makes frequent visits of inspection and supervises the general lines of the instruction given.

In order to ensure proper co-ordination of the work in Malacca with agricultural education at Serdang, occasional visits are made by the Principal, School of Agriculture, Malaya, in an advisory capacity.

Qualifications for Admission.

The School is, at present, non-residential. This entails that pupils who reside at a distance and are unable to return daily to their homes have, of necessity, to make their own arrangements regarding board and lodging in Sungei Udang or other near-by villages.

Admission is open to candidates of all nationalities, but a good knowledge of the Malay language is essential as the course is conducted in that language.

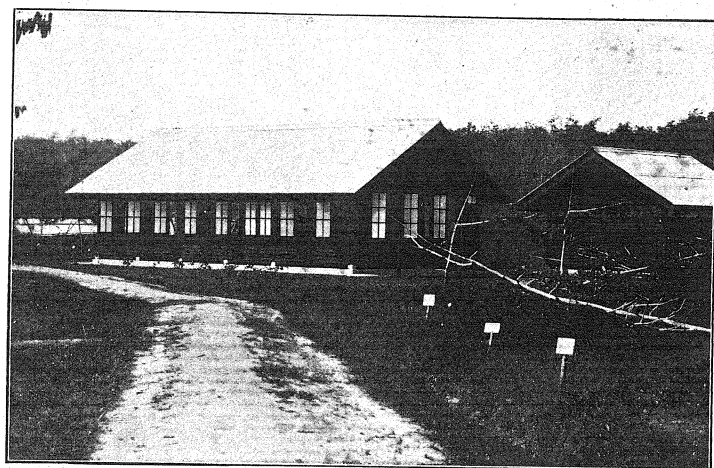
Candidates for admission must be not less than 15 years of age and must have passed either the highest standard in a vernacular (Malay) school or at least Standard V in an English school.

Tuition fees are payable at the rate of $3 per term ($9 per annum).

A number of scholarships, involving the remission of tuition fees only, are awarded annually, on the results of a competitive, written examination and an enquiry into the circumstances of the candidate, preference being given to those whose parents or guardians are the cultivators of land within the Settlement, on which it is their intention that the candidate shall find employment on the conclusion of his studies.

Curriculum.

The school year normally commences shortly after the termination of the Mohammedan fasting month and ends just prior to the commencement of the next



School Buildings, The Farm School, Malacca

Students' Individual Plots, The Farm School, Malacca

fasting month. It consists of three terms, each of approximately 13 weeks duration, separated by two vacations of 3 weeks each.

The hours of work are from 7.30 a.m. to 1 p.m. daily, except on Fridays and Saturdays when the School closes at noon. This allows 23 hours of work in each week, of which 15 hours are devoted to field work, which is engaged in from 7.30 a.m. to 10. a.m. daily. There is an interval from 10 a.m. to 11.30 a.m. daily except on Fridays and Saturdays when it terminates at 11 a.m.

The summaries which follow give a broad outline of the scope of the course and the nature and extent of the class and field work.

Summary of Class Work.

		Hours Weekly.
(1).	Principles of agriculture ...	$2\frac{1}{4}$
(2).	Field crops ...	$2\frac{1}{4}$
(3).	Animal and poultry husbandry ...	1
(4).	Arithmetic ...	1
(5).	Economics ...	$\frac{3}{4}$
(6).	General ...	$\frac{3}{4}$
	Total ...	8

Summary of Field Work.

(1). Collective work on adjoining Agricultural Station.

(2). Individual plots for the cultivation of annual crops (1/60th acre per pupil).

(3). Demonstrations, experiments and practical work on subjects arising from lectures.

The teaching in class is rendered as simple as possible, having regard to the type of education required by pupils whose future lies in small-holding agriculture. In this respect, the Farm School course differs materially from the lower of the two courses at the School of Agriculture, Malaya.

Permanent and semi-permanent crops under cultivation on the Agricultural Station and available for collective work by the pupils of the School include tea, coffee, various types of local fruits, citrus, arecanuts, gambier, pepper, kapok, cloves, nutmegs, rubber, pineapples, tuba, Manila hemp, bananas, sugar cane and papaya. In addition, there are a number of annual crops under more or less continual cultivation including padi, maize, tobacco, turmeric, ginger, groundnuts, gingelly, tapioca and sweet potatoes together with numerous vegetable, green manure and cover crops and fodder and pasture grasses.

Progress of School.

The School made a very successful start, with a full complement of 25 pupils, of whom five are the holders of scholarships, awarded following an examination.

All the entrants are Malays and each of the three Administrative Districts of the Settlement is represented. Alor Gajah District has the largest representation, which is only to be expected having regard to the situation of the School.

The success attained in recruiting a full complement of pupils for the opening year is to be attributed to suitable advertising, by means of circulars in the Jawi character distributed to all headmen and vernacular schools throughout the Settlement, and through the medium of the local press. In addition, prior to the inception of the School, the Instructor made a tour of the Settlement for the purpose of addressing local audiences on the objects and mode of working of the School.

The general progress since opening has been excellent, the majority of the pupils having shown commendable keeness in their work.

A number of additions have been made, of late, to the equipment. These include the provision of a rubber smoke cabinet, a rubber manufacturing shed and a copra kiln, all suitable for adoption by native agriculturists. In addition, a flock of poultry of native breeds, together with the appropriate houses and other accessories, are being provided for instruction purposes in poultry husbandry. As the rubber planted on the Agricultural Station is, as yet, far from mature, instruction in tapping is conducted on an adjacent, privately-owned, holding.

It has been obvious for some time that the school would function better if it were residential. The system whereby those pupils who come from a distance have to make their own arrangements regarding board and lodging does not work well in practice, and, if the School is to continue to draw pupils from all parts of the Settlement, which is desirable, some other arrangements may well have to be made. The provision of hostel accommodation appears to be the only way of overcoming this difficulty.

To conclude, the ability of the School to fulfil its major object is a matter which only the future can prove. Touch must be maintained with the first batch of pupils, who will complete their course of training in November of this year, after they have returned to their respective homes, in order to ascertain whether or not they are fulfilling the object of their training, and so on with subsequent batches. In the matter of recruitment for the School year of 1937, upwards of one dozen applications have already been received, which may be regarded as satisfactory.

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CONDITIONS ON RUBBER SMALL HOLDINGS IN MALAYA.

1st Quarter, 1936.

Prepared by the Economic Branch of the Department of Agriculture, S.S. and F.M.S., in collaboration with the Field Branch of the Department.

Rainfall.

The quarter under review was exceptional for the hot, dry weather experienced during February in nearly all parts of the Peninsula. January and March were extremely wet almost without exception, but in some districts the dry weather of February was extended to the first half of March.

Prices.

In common with the market rise in price of rubber, prices for small-holders' rubber steadily increased and, in March, reached $35 per picul in one district. The difference between smoked and unsmoked sheet was, at many centres, extremely small, and particularly noticeable were the relatively high prices paid for scrap.

Table I shews the range of prices paid for small-holders' rubber at several centres in each State or Settlement, and Table II gives the means of the range.

Production.

Production of rubber on small holdings during the first quarter of 1936 is given in Table III together with the relative figures for 1935. This table is compiled from the monthly report of stocks, imports and exports of rubber published by the Registrar-General of Statistics, S.S. and F.M.S.

Tapping.

Table IV summarizes the results of the quarterly survey of small holdings out of tapping. The estimates are obtained by counting the number of such holdings, and applying the percentage to the total area of small holdings in the District.

There was a still further increase in the acreage out of tapping during the quarter under review. The comparative figures are as follows:—Federated Malay States: December 1935, 203,900 acres (38 per cent.), March 1936, 219,300 acres (41 per cent.); Straits Settlements: December 1935, 33,100 acres (28.4 per cent.), March 1936, 39,400 acres (33.8 per cent.).

The acreage estimated to be out of tapping at the end of March 1935 was as follows:—Federated Malay States 93,100 acres (17.5 per cent.); Straits Settlements 17,900 acres (15.4 per cent.).

The area out of tapping on small holdings in the State of Johore at the end of March was estimated to be 43 per cent. or 138,600 acres, as compared with

Table I.

Lowest and Highest Rubber Prices Paid by Local Rubber Dealers.

(In Straits dollars per picul (133 1/3 lbs.))

1st Quarter 1936.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore
JANUARY								
Smoked sheet	29.00-31.50	25.00-30.80	25.00-31.00	26.00-31.00	26.00-32.90	29.00-33.50	28.00-33.20	26.00-31.50
Unsmoked sheet	28.00-31.00	22.00-30.00	22.00-28.00	25.00-30.00	23.00-29.50	27.50-31.75	26.00-32.30	24.00-30.00
Scrap	19.00-25.00	—	23.00-27.00	20.00-27.00	—	24.00-29.00	20.00-27.00	23.50-27.50
FEBRUARY								
Smoked sheet	31.20-34.50	28.00-33.80	26.00-33.35	30.00-33.30	27.00-33.20	32.00-33.50	30.00-33.50	29.80-33.80
Unsmoked sheet	30.00-33.80	26.70-33.50	26.00-31.50	26.00-32.00	24.50-31.70	30.50-32.00	30.00-32.40	28.00-32.60
Scrap	24.00-28.50	26.00	26.00-28.00	25.00-28.00	—	27.00-28.50	26.50-28.00	25.00-30.00
MARCH								
Smoked sheet	32.50-35.00	30.50-33.80	28.00-33.60	30.00-33.50	28.00-33.40	32.00-34.00	32.60-34.00	28.50-33.50
Unsmoked sheet	31.00-34.00	29.00-32.80	24.00-32.20	29.00-33.00	29.00-32.00	30.00-32.50	31.00-33.00	28.00-33.00
Scrap	25.00-28.75	28.00	26.00-29.00	25.00-28.00	—	28.00-31.00	26.50-29.00	27.00-30.00

Table II.

Mean of Lowest and Highest Rubber Prices Paid by Local Dealers at a number of Centres in each State.

(In Straits dollars per picul (133 1/3 lbs.))

1st Quarter 1936.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore
JANUARY								
Smoked sheet	29.38-31.08	27.84-29.63	27.47-30.08	26.80-30.40	27.42-30.93	30.16-31.50	29.06-30.35	28.33-29.97
Unsmoked sheet	28.38-30.25	26.14-28.73	24.66-27.33	25.30-29.10	25.50-28.62	28.66-29.75	28.07-29.20	27.02-28.88
Scrap	22.22-23.48	—	24.50-26.00	23.13-26.42	—	26.16-26.50	23.00-24.50	24.83-25.93
FEBRUARY								
Smoked sheet	32.00-33.68	30.20-32.55	29.42-31.56	30.20-32.72	29.85-32.51	32.33-33.33	31.62-32.90	30.69-32.53
Unsmoked sheet	30.50-32.95	28.87-30.96	27.83-29.76	28.40-31.60	27.88-30.92	30.66-31.66	31.25-32.15	29.26-31.12
Scrap	25.66-27.16	26.00	26.00-27.75	25.66-27.83	—	27.33-28.33	26.83-27.70	27.31-28.64
MARCH								
Smoked sheet	32.75-34.25	31.71-32.99	31.25-32.88	31.30-33.26	30.67-32.53	32.83-33.70	32.97-33.42	31.51-32.85
Unsmoked sheet	31.38-33.50	30.40-31.58	28.00-29.80	30.10-31.90	29.88-31.45	31.08-32.50	31.62-32.32	30.72-32.12
Scrap	26.38-27.94	28.00	27.00-28.50	26.00-27.50	—	28.33-29.66	27.16-28.66	28.33-29.29

Table III.

Production of Rubber on Small Holdings.

(in tons)

	Total Year 1935	1st Quarter 1935	1st Quarter 1936
Federated Malay States ...	67,380	16,736	14,796
Unfederated Malay States ...	54,861	16,021	11,561
Straits Settlements ...	13,258	2,867	2,997
Total ...	135,499	35,624	29,354

35 per cent. or 137,400 acres at the beginning of January. The lack of proportionate increase in the acreage quoted is due to the fact that a revised figure for the total acreage of rubber small holdings in Johore has been received from the Johore Restriction Office, and is considerably lower than the previously accepted figure.

The area out of tapping in Kedah was estimated to be 50,900 acres (50.5 per cent.) as compared with 38,300 acres (38 per cent.) at the beginning of the year.

Ignoring Perlis, Kelantan and Trengganu, in which States the area of rubber small holdings is relatively small, the total area of rubber on small holdings out of tapping at the end of the first quarter 1936 was estimated to be 448,200 acres, or 41.8 per cent.

The extremely high price obtainable for coupons was again the principal reason adduced for the continued increase in the areas untapped. Coupons were sold at $25 per picul equivalent, and, in many cases, the quarter's issue was disposed of in the first month. Where coupons have not been sold, they are usually exhausted before the end of the quarter, resulting in the relative holdings being untapped.

Padi harvesting was, as usual, responsible for a reduction in tapping, and an even more important factor was the incidence of "wintering", which in some districts was severe, resulting in lessened flow of latex.

Table IV.

Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less than 100 Acres, at the end of March, 1936.

PERAK

District	Total Tappable area	Total area untapped	Percentage
Batang Padang	37,288	13,000	35
Kinta	34,180	6,500	19
Kuala Kangsar	43,485	23,500	54
Upper Perak	13.774	7,200	52
Larut & Selama	51,407	7,700	15
Krian	9,751	8,500	87
Lower Perak*	47,937	25,900	54
Dindings	7,279	6,300	86
	245.101	98,600	40

SELANGOR

District	Total Tappable area	Total area untapped	Percentage
Klang	18,879	7,200	38
Kuala Langat	29,263	9,400	32
Ulu Langat	38,867	13,600	35
Ulu Selangor	30,632	10,100	33
Kuala Lumpur†	21,174	7,200	34
Kuala Selangor†	9,379	3,200	34
	148,194	50,700	34

NEGRI SEMBILAN

District	Total Tappable area	Total area untapped	Percentage
Seremban	19,241	17,900	93
Tampin	17,947	13,100	73
Kuala Pilah	17,470	8,900	51
Jelebu	6,270	2,400	39
Port Dickson	10,653	8.000	75
	71,581	50,300	70

PAHANG

District	Total Tappable area	Total area untapped	Percentage
Raub	7,361	4,800	65
Kuala Lipis	15,951	2,700	17
Bentong	13,600	3,100	23
Other Districts †	31,223	9,100	29
	68,135	19,700	29

MALACCA

District	Total Tappable area	Total area untapped	Percentage
Central	17,687	9,000	51
Alor Gajah	31,387	14.400	46
Jasin	24,971	4,500	18
	74,045	27,900	35

PENANG & P. WELLESLEY

District	Total Tappable area	Total area untapped	Percentage
North	3,241	800	24
Central	7,067	2,000	29
South	8,149	6,100	75
Penang	11,114	1,600	14
	29,571	10,500	36

SINGAPORE

District	Total Tappable area	Total area untapped	Percentage
Singapore	12,781	1,000	8
	12,781	1,000	8

Johore	322,225	138,600	43
Kedah	100,691	50,900	50,5

The percentage of areas out of tapping in December, 1935, was as follows:—Perak 29, Selangor 29, Negri Sembilan 64, Pahang 65, Malacca 30, Penang and Province Wellesley 31, Singapore 9.

* Estimated from percentage for Kuala Kangsar.

†Estimated from percentage for other Districts in the State.

Condition of Holdings.

Reports indicate that a satisfactory standard of upkeep is being maintained, due in large measure to the work of Asiatic Rubber Instructors to which reference is made elsewhere in this summary.

One welcome result of the reduction in tapping is the extended resting period the trees are obtaining with consequent substantial improvement in bark renewal.

Diseases.

Both wet and dry root rot have been observed in all Districts of Perak Central, the most serious cases being in Sitiawan and the Dindings on the large holdings, where control measures are being carefully carried out. In other Districts the Malays are inclined to neglect control measures in spite of advice given.

The report from Pahang indicates that a fair amount of root disease is also to be found in most small holdings in that State. The report adds that little attention is given to control in the majority of cases, but that in a few areas, following the advice of the Asiatic Rubber Instructors, isolation drains have been dug.

Several cases of root diseases were treated in the Bandar Bharu District of Kedah.

Minor outbreaks of Pink Disease were reported from Lipis and Temerloh Districts, and all cases were under treatment. This disease was also reported in the Kluang District of Johore.

Mouldy Rot was in general evidence, but, in most parts of the Peninsula, the dry weather of February and early March was unfavourable to its spread.

On the other hand the dry weather, following "wintering", has been responsible for the widespread re-appearance of secondary leaf fall, *Oidium Heveae*, but nearly all reports state that the attacks are not serious.

Grades of Rubber.

Reports indicate that the general tendency is towards a preference for unsmoked sheet, but this is undoubtedly due to the high price which is being paid for this grade, making it almost uneconomic to smoke sheet.

It has been decided, however, to restrict the All-Malayan Rubber Small-Holders' Competition to smoked sheet only, and small-holders have been advised of this fact.

Kedah.—There was an increase in the production of smoked sheet, but in Central Kedah the percentage of scrap sold was exceptionally high. The percentages of smoked and unsmoked sheet respectively were:—North Kedah 90, 9; Central Kedah 50, 14, (scrap 36); South Kedah 51, 45.

Perak.—There is marked preference for unsmoked sheet in nearly all parts of Perak. At Selama, smoked sheet continues to be the form in which the majority of the rubber is sold. At Bagan Serai the percentages were:—smoked

31, unsmoked 69. At Taiping the majority of rubber sold was smoked. In Perak Central the percentages were:—smoked 49, unsmoked 51, and in Perak South 34.6 and 65.3 respectively.

Selangor.—The production of unsmoked sheet is reported to be decreasing, most of the rubber sold being in the form of smoked sheet.

Penang and Province Wellesley.—Percentages of sales of smoked and unsmoked sheet were only slightly changed as compared with the previous quarter; they were: smoked 9.5 and unsmoked 85.5.

Malacca.—There was a slight variation in the percentages of grades sold which were as follows:—Central, smoked 76, unsmoked 20; Alor Gajah, smoked nil, unsmoked 98; Jasin, smoked 59, unsmoked 40.75.

Negri Sembilan.—There was a considerable increase in the production of smoked sheet, the average percentages of the sales of 27 dealers being: smoked 53, unsmoked 47.

General.

The Asiatic Rubber Instructors continue to do good work, and much interest is shewn in the cheap form of smoke house which they are exhibiting, although, as mentioned elsewhere in this report, the fact that the present difference in price between smoked and unsmoked sheet is small minimizes the chances of extending the use of these smoke cabinets. Even so, a large number have been erected during the quarter under review, and a number more are under construction.

In Perak, sulphuric acid coagulants are still widely used by small-holders, as they are much cheaper and are sold in convenient quantities. In Selama, Perak, however, formic acid, usually at a reasonable price, is in general use, but it appears that unless this acid can be supplied at competitive rates there is little prospect of converting the average small-holder to its use.

In Pahang a scheme has been inaugurated in all Districts whereby rubber dealers are required to display samples of the various grades of rubber, shewing the difference in price between such grades. The object is to obtain a higher price for the better grade produced, and also to shew small-holders the value of grading, and the losses they incur if they produce a low-grade product. The scheme has been adopted by the dealers without much complaint, and at the end of the quarter all dealers were carrying out instructions.

Reviews.

An Outline of Malayan Agriculture.

Compiled by D. H. Grist. 388 pp. 86 plates and 2 maps. Malayan Planting Manual No. 2. Department of Agriculture, S.S. and F.M.S. 1936. Price $3 Straits currency or 7 shillings post free.

Agriculture in Malaya has developed rapidly in recent years, its growth being accelerated by the collapse of the rubber and tin markets which focussed attention on the need for investigation into the potentialities of other natural sources of wealth.

With this change in agricultural conditions the need became obvious for an authoritative publication which would present a clear-cut picture of Malayan agricultural development, together with such an outline of the history, geography and geological structure of the Peninsula as is necessary for a clear understanding of the main subject, and with an account of the crops which can be grown in the country, methods of cultivation, and economic possibilities.

The Department of Agriculture, Straits Settlements and Federated Malay States, accordingly undertook the production of *An Outline of Malayan Agriculture* to provide a comprehensive summary of the chief historical features and of the present agricultural life of the country.

The book is divided into six parts with a total of 33 chapters, together with appendices and an index.

The introductory chapter in Part I deals briefly with the geographical position of Malaya, its climate, geology and soils; followed by paragraphs on its political geography, communications, population, and agricultural industries. Other chapters in this Part concern the system of land tenure, agricultural policy, agricultural co-operation and the organization of agricultural services.

Part II comprises two chapters dealing respectively with methods of cultivation and soil treatment. These subjects are treated in a general way, as more precise information is given on the same subjects in the subseqent discussion of various crops.

The following three Parts contain information on the history, methods of cultivation, soils suitable, areas under cultivation, preparation for market, trade and market prices of tropical crops found in Malaya and of such sub-tropical or temperate-climate crops as have attracted attention in the highland region of the country. The last Part is concerned with cattle, pigs, poultry and fresh-water fish. The chapters summarize the present position in connexion with stock-raising and the advances made to-date in effecting improvements, as regards the quality of stock, feeding and housing.

The appendices give a list of import and export duties on agricultural products, a comprehensive bibliography of Malayan agriculture, and tables of local weights and measures.

The illustrations are clear, and definitely assist the text, while the inclusion of a general map of Malaya and of a geological map further assists the reader.

While *An Outline of Malayan Agriculture* is designed primarily for those interested in agriculture in the Malay Peninsula, it is thought that its appeal will not be confined to these shores. Agriculturists in other tropical countries may find within its pages information that may result in developments in their own regions, while agricultural training centres may consider the range of crops described as typical of a large number of tropical countries throughout the world.

The Chemistry of Milk.

W. L. Davies. 522 pp. Chapman and Hall Ltd., London, 1936. Price 25 shillings.

A new work on the chemistry of milk is justified if it is sufficiently comprehensive in its scope, and gives adequate consideration to the long established knowledge of the subject, new aspects of old work and to the more recent work on the subject. Within the five parts of this book dealing with the composition, constituents and physical chemistry of milk, the chemistry of milk processing and the nutritive value of milk, the author covers the subject very thoroughly, while the 1,400 references included in the text are evidence of the close consideration which has been given to the relevant and important investigations which are scattered in scientific literature and specialized text-books.

The author writes for both pure and applied chemists, physiologists, nutritionists and for members of the medical profession. He adds that the contents will also be of value to research workers in biochemistry, agricultural chemistry and the chemistry of foods, since the present position of many subjects is explained and indications given of future problems requiring solution.

The book is commended because the author has achieved his object with conspicuous success.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports submitted by Agricultural Officers.

April 1936.

The Weather.

The weather during April was showery, as is usual for this month; precipitation was somewhat below normal in many areas, but in others it was equal to or in excess of the average. The latter included the areas around Taiping, Kuala Kangsar and Telok Anson, the Kuala Lumpur District and country round Kuala Selangor, Jelebu District, Raub, Temerloh and Kuantan Districts, the coast of Kelantan and the inland parts of Johore. Along the west coast, however, from Krian southward, rainfall was deficient practically throughout, while in Bagan Datoh and Sabak Bernam Districts and on the coast of Muar District very dry conditions, with only about 2 inches of rain, were experienced.

Remarks on Crops.

Padi.—Harvest was practically completed everywhere at the end of the month. In Kedah, crop returns show a total of 96,000,000 gantangs, which is probably the highest crop on record and is due in part, at least, to an increase in the planted area. The crop in Penang and Province Wellesley is known to be considerably below that of 1935, while that in the Bruas District of Perak was poor. Elsewhere, however, average crops were expected. Some good yields were recorded from the Panchang Bedena area in Selangor.

Work on this season's crop was in progress in the inland parts of Selangor, the riverine mukims of Pahang and in northern and central Johore.

At the request of the people of Semantan mukim in Temerloh District of Pahang, two expert ploughmen from Malacca worked in the mukim for 21 days during the month, their expenses being provided collectively by the local padi growers. The latter thus were able to acquire considerable knowledge of ploughing and of the manufacture of the wooden parts of ploughs and harrows.

Surplus padi from the Panchang Bedena area was being purchased in considerable quantities by Chinese dealers for export to Port Swettenham and other small ports along the Selangor coast for feeding poultry. The price given was $6.50 per 100 gantangs.

Local demand for pure strain padi seed in Malacca was, as usual, greatly in excess of the supply, so that rationing by Districts was necessary. It was reported that secondary distribution was taking place to a considerable extent through the medium of cultivators who are already growers of these strains. Siam 29 and Nachin 11 were the strains most in demand.

Rubber.—Wintering in northern and central Pahang was late and irregular, and had not terminated by the end of the month. This was in strong contrast to the early and rapid leaf fall which occurred in most other parts of the Peninsula.

The new issue of export coupons to small-holders was made at the beginning of the month. Somewhat contrary to expectations this issue did not cause a great increase in the number of holdings tapped, except in areas such as Penang and Province Wellesley, parts of Selangor, Malacca, central Pahang and south Johore, where peasant proprietors and paid tappers have no other work to which they can turn their attention. Tappers cannot usually obtain a full quarter's work at an adequate wage because, when coupons are exhausted, the sale of uncouponed rubber does not permit of sufficient payment to support them. Owners of land can make about as much by selling their coupons without tapping as they can by selling couponed rubber after deducting tapping costs. Consequently, where other occupations are available, such as padi work, fishing, or employment as labourers on estates or public works, both owners of land and tappers prefer these other sources of income to tapping rubber.

One effect of the new issue of coupons was to lower their price from a maximum of $28 to a range of $24 to $27 per picul of export rights. The price of rubber without coupons rose correspondingly to as much as $9 per picul for smoked sheet and $6 to $8 for unsmoked sheet.

Leaf mildew (*Oidium Heveae*) was reported from several localities in Kedah and was found for the first time on three estates and adjoining small holdings in the Temerloh District of Pahang. The disease continued to be present in all the areas from which it was reported in March, but towards the end of the month it began to clear up. Except in a few instances in which sulphur dusting had to be undertaken, the outbreak was mild.

The Asiatic Rubber Instructors have effected a definite improvement in the quality of the sheet made in some of the areas where they have been working and have secured the erection of several additional smoke cabinets. The margin between the price of smoked and that of unsmoked sheet continued, however, to be quite small and so to offer little inducement to prepare smoked sheet.

Copra.—The "twin" kiln, with twice the capacity of the "30-acre" kiln described in the April number of this Journal, was further tested in Bagan Datoh District during the month. The tests showed conclusively that copra of estate quality could be made on this kiln in 30 hours. The size of the kiln is better adapted to the requirements of small-holders, the "30-acre" kiln being too small for reasons given in this summary for March. Two "twin" kilns were built in Johore North and were reported to be working satisfactorily at the end of the month. In Johore as in Bagan Datoh District, the "30-acre" kiln is considered too small, but the "twin" kiln has attracted considerable attention.

In Province Wellesley the crop of nuts increased and, in consequence, competition for supplies became so much relaxed that Malay kiln-owners were again able to commence making copra.

Pineapples.—Supplies of fruit gradually increased during the month, so that factories were able to work steadily, though not at full capacity. Eight were working in Johore, four in Singapore and one in Selangor. In Selangor prices for fruit were $1.20 to $1.50, but in Johore from $1.80 to $3 and in Singapore $2.10 per hundred.

Fruits.—In certain parts of the country small areas of water melons have produced crops. These sold at prices varying from 12 to 20 cents each. In Jelebu District of Negri Sembilan durians and langsats were fruiting and small quantities were being sold on the Seremban market.

Agricultural Stations and Padi Test Plots.

At the Kuala Kangsar Station the first fruits from imported Marsh's Seedless Grapefruit trees were harvested. These were examined and thought to be rather poor in quality, but this may improve somewhat when the trees have been fruiting for a longer period. Two Lisbon Lemon trees at Bukit Mertajam Station were also bearing their first fruits which, of their kind, were of better quality than the grape fruits. Both the lemon and the grapefruit trees are budded plants which were imported from South Africa in 1932.

In Kelantan 10 acres of land at Bachok were being cleared for development as an Agricultural Station to include wet and dry padi, permanent and rotation crops.

In Johore the work of clearing the Agricultural Station site at Tangkah was continued and plots and paths were demarcated. Clearing work was continued on the site of the Central Experiment Station at Ayer Hitam and felling was commenced on the land reserved for a Pineapple Experiment Station and Agricultural Station in south Johore.

Harvest was completed or nearly completed on the Panchang Bedena and Sungei Haji Durani Padi Test Plots in Selangor, the Lipis and Sungei Blat Test Plots in Pahang, the Tangkah Plot in Johore North and the Kilanas and Lumapas Plots in Brunei. Yields on the Lipis Plot were disappointing owing to unfavourable weather conditions during growth, being on the average little over 100 gantangs per acre. The best yielding strains were Siam 29 with 350 gantangs, Reyong 20 with 344 gantangs and Nachin 66 with 310 gantangs per acre. On the Tangkah Plot all selected strains did well, with the exception of Radin 7, while the Nachin and Siam strains yielded over 400 gantangs per acre. The four local varieties grown proved mediocre in yield, the best being Serendah Kuning. On the Kilanas Plot Seraups 15 and 36, Siam 29 and 76 and Nachin 66 gave fairly good crops and the native variety Jongkok yielded well. On the Lumapas Plot there were no Latin Square variety trials, but preliminary single plant selections were made from the local varieties Jongkok, Pulut Merikan and Radin Pasir. In the multiplication plots of these varieties Jongkok gave 375 gantangs and both Radin Pasir and Pulut Merikan 295 gantangs per acre.

Land was prepared for planting and nurseries were sown on the Kajang Test Plot in Selangor, the Kendong and Kuala Klawang Test Plots in Negri Sembilan and the Jementah and Tenglu Test Plots in Johore.

All-Malayan Padi Competition.

Mukim padi competitions were held in ten centres of the Tampin-Rembau District in Negri Sembilan. The total number of exhibits was only 139, a further drop compared with the figures for the two preceding seasons. In this District the falling off in the number of exhibits appears to be due to the fact that a three gantang exhibit is considered too heavy to bring from any distance, unless easy means of transport are available. Reasonably large exhibits are, however, necessary to the purposes of the competition.

In Pahang East a series of competitions was held in the riverine mukims of Pekan District. The number of entries at each centre was very encouraging and the attendance, which consisted mostly of the exhibitors themselves, was good.

District Agricultural Show, Segamat.

A District Agricultural Show was held at Segamat in Johore on April 16th and 17th and was opened by His Highness the Tengku Makhota. The attendance during the two days was estimated at 16,000 and included a number of distinguished visitors. In this respect the Show was a success. The quality and number of exhibits were, however, disappointing, except in the padi and livestock sections, mainly because the Show was held too early in the year, many exhibits for which classes were provided, especially in the fruit section, being out of season. The winning padi as in 1935 was Nachin Puteh.

The Department of Agriculture staged an exhibit dealing with the subjects of padi, budded fruit trees, tobacco, arecanuts, coffee, tapioca and gambier together with models of poultry houses. A small-holder's rubber smoke cabinet was erected and on both days the Asiatic Rubber Instructor gave demonstrations on the preparation of first quality smoked sheet.

Holiday Course for Schoolboys.

During the period April 14th to 18th inclusive, a holiday course on certain agricultural subjects was given at the Bukit Mertajam Agricultural Station in Province Wellesley to a large and enthusiastic class of pupils from the Bukit Mertajam High School.

DEPARTMENTAL NOTES.

Visits of the Adviser on Agriculture.

The Hon'ble the Director of Agriculture, S.S. and Adviser on Agriculture, Malay States, visited Singapore and Johore on 17th and 18th April, 1936. In the morning of the first day he discussed questions concerning the pineapple canning industry with the Health authorities and the Registrar-General of Statistics. In the afternoon, accompanied by Mr. W. J. Johnson, Canning Officer, he attended a conference in Singapore of pineapple packers.

On 18th April, accompanied by the Canning Officer, the Agricultural Adviser conferred with the State Agricultural Officer, Johore, and with the Sanitary authorities in Johore regarding the pineapple packing industry. In the afternoon, he visited pineapple factories in Johore and the site for the new Pineapple Experimental Station at Kota Tinggi, Johore.

Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on 13th April, 1936.

Appointment.

Mr. J. R. P. Soper, B.A., Agricultural Officer, Zanzibar, has been appointed Agricultural Officer, Department of Agriculture, S.S. and F.M.S. from 2nd April 1936. Mr. Soper arrived in Malaya and took over the duties of Agricultural Field Officer, Province Wellesley and Penang, on 23rd April, 1936.

Rural Lecture Caravan.

The Rural Lecture Caravan toured Penang and Province Wellesley during the month. Large audiences were attracted at all centres.

Refresher Course at School of Agriculture.

A Refresher Course for Malay Agricultural Assistants in this Department was given at the School of Agriculture, Malaya, from 20th to 23rd April inclusive.

Leave.

Mr. R. A. Altson, Assistant Mycologist, has been granted 8 months and 2 days leave from 9th May 1936 to 10th January, 1937.

Statistical.

MARKET PRICES.

April, 1936.

Major Crops.

Rubber.—The market improved still further during April, but weakened suddenly at the close upon the announcement of the increase in the quota. Spot loose opened at $26\frac{1}{8}$ cents per lb. and rose steadily to $26\frac{7}{8}$ cents on the 16th and 17th April; thereafter the price fell slightly, and later dropped to $26\frac{1}{8}$ cents on the 29th, closing at 26 5/16 cents. The average price for April of No. I X. Rubber Smoked Sheet was 26.49 cents per lb. as compared with 26.04 cents in the previous month. The London average price was 7.53 pence per lb., and the New York price 15.92 cents gold, as compared with 7.44 pence and 15.86 cents gold in March.

Prices paid for small-holders' rubber at three centres during the month are shewn in the following table.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, April, 1936.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.					Kuala Kangsar, Perak.				Batu Pahat, Johore.				
	2	9	16	23	30	1	15	22	29	1	8	15	22	29
Smoked sheet			34.00	33.50	33.64	32.80	33.57	34.00	34.00		33.25	33.60		32.49
Unsmoked sheet	32.55	32.12	32.00	32.90	32.00		32.42	33.00	32.00	31.70	32.40		32.00	32.00
Scrap		26.80	28.00	29.00							30.00			

Transport by F. M. S. R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent

No purchases at Kuala Kangsar on the 8th April.

Palm Oil.—Prices weakened still further during April, and are given in the following table.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1936.	Palm Oil in Bulk, c i.f. landed weight Liverpool/Halifax. per ton	Palm Kernels, c.i.f. landed weight London/Continent per ton
April 3	18. 5 0	10 0. 0
„ 10	18. 0. 0	10. 0. 0
„ 17	17 0. 0	9. 15. 0
„ 24	17. 0 0	9. 10. 0

Copra.—The market continued to fall during April, after an improvement during the first week; thereafter the price fell steadily. The sun-dried grade opened in Singapore at $5.25 per picul, and closed at $4.50, the monthly average being $5.03 per picul as compared with $5.09 in March. The mixed quality did not fall proportionately, the difference between the two grades being only 30 cents at the close and the average price remained unchanged at $4.59 per picul.

Copra cake improved still further and averaged $1.55 per picul as compared with $1.32 in March.

Rice.—The average wholesale prices of rice per picul in Singapore for March were as follows:—Siam No. 2 (ordinary) $3.85, Rangoon No. 1 $3.30, Saigon $3.60, as compared with the February corresponding prices of $3.81, $3.35 and $3.35. March 1935 prices were $3.77, $3.45 and $3.55.

The average retail market prices in cents per gantang of No. 2 Siam rice in March were:—Singapore 30, Penang 28, Malacca 26, as compared with 32, 28 and 26 respectively in February.

The average declared trade value of imports of rice in March was $3.56 per picul, as compared with $3.46 in February, and $3.64 in January.

Padi.—The Government Rice Mill at Krian were offering $2.10 per picul for padi but purchases were negligible. The Government Rice Mill at Temerloh, Pahang, reduced its price from $2 to $1.90 per picul on the 10th April. Retail prices of padi ranged from 5 cents to 14 cents per gantang, these extremes being quoted in Johore only.

Pineapples.—Packers reduced prices during April, and the market was quiet with not much business passing. Average prices per case for the month were:—Cubes $3.16, Sliced Flat $3.07, Sliced Tall $3.16, as compared with $3.27, $3.16 and $3.25 respectively in March.

Prices of fresh fruit per 100 were: Selangor $1.20 to $1.50; Johore $1.80 to $3; Singapore $2.10.

Beverages.

Tea.—Six consignments of Malayan tea were sold on the London Market in April. Two consignments were of upland tea and averaged 1s. 0½d. and 1s. 1d. per lb. and the remaining consignments, of lowland tea, were sold at prices of 1s. 0d. and 1s. 0¼d. per lb.

Average London prices per lb. during April for tea consignments from other countries were as follows:—Ceylon 1s. 3.93d., Java 10.93d., Indian Northern 1s. 0.77d., Indian Southern 1s. 2.02d., Sumatra 10.47d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report*, 21st April, 1936, of the Colombo Brokers' Association, and are as follows (rupee cents per lb.):—High Grown Teas 66 cents, Medium Grown Teas 59 cents, Low Grown Teas 57 cents.

Coffee.—Prices of coffee in Singapore were lower during April. Sourabaya coffee fell from $12 to $14 per picul to $12 to $13, and Palembang coffee averaged $7.10 to $8.10 per picul, as compared with $7.31 to $8.37 in March.

Prices of locally-grown coffee remained on a low level, ranging from $12 to $28 per picul for both robusta and Liberian. The latter quality was quoted at $8 per picul in Singapore.

Spices.

Arecanuts.—Singapore prices improved during April, and average prices per picul were:—Splits $4.45 to $6.10; Red Whole $5.35 to $6.40; Sliced $8.30 to $9.30.

The Singapore Chamber of Commerce average prices per picul were:—Best $6.12, Medium $5.58, Mixed $4.24, as compared with $6.17, $5.60 and $4.35 respectively in March.

Pepper.—The market in Singapore is stagnant and prices are nominal; they remained the same as in the previous month and were:—Singapore Black $8.50, Singapore White $16, Muntok White $16.50 per picul.

Nutmegs.—Prices improved slightly at the beginning of the month and weakened again in the second half. Average prices per picul were: 110's $29.25, 80's $30.25, as compared with $28.25 and $29 respectively in March.

Mace.—Siouw opened at a higher level but weakened early in the month, averaging $91.25 per picul as against $92.50 in March. Amboina was quoted throughout at $75 per picul as compared with an average price of $73.75 in the previous month.

Cloves.—Nominal quotations of both Zanzibar and Amboina continued unchanged at $38 per picul.

Cardamoms.—Green cardamoms were quoted in the Ceylon Chamber of Commerce reports at Rs. 1.20 to Rs. 1.35 at the beginning of April, rising to Rs. 1.35 to Rs. 1.43 at the close.

Miscellaneous.

Tuba Root (*Derris*).—The Singapore market was quiet during April. Prices were irregular but the averages for the month were unchanged in comparison with March; they were: roots sold on rotenone content $52 per picul, and on a basis of ether extract $34.50.

Gambier.—A slight fall in the price of Block in the second half of April reduced the month's average to $6.25 per picul as compared with $6.50 in March. No. 1 Block remained unchanged at $10.50 per picul.

Tapioca.—Prices again continued unchanged, and were:—Flake, Fair $5.50, Seed Pearl $5.50, Medium Pearl $6.50 per picul.

Sago.—Pearl, Small Fair, was quoted throughout the month at $3.80 per picul as compared with an average price of $3.75 in March. Flour, Sarawak Fair, fell 2½ cents at the beginning of the month but recovered at the close. The average price was $2.30 per picul as compared with $2.35 in March.

Tobacco.—Prices in Kelantan were $75, $60 and $50 per picul for first, second and third qualities respectively. Elsewhere, prices were lower, ranging from $25 to $35 for first quality, $21 to $28 for second quality, and from $10 to $20 for third quality.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross. London, S.W.1.

GENERAL RICE SUMMARY*

March, 1936.

Malaya.—March imports of foreign rice were 53,435 tons, and exports 13,785 tons. Net imports for January to March totalled 123,586 tons, an increase of 9.3 per cent. as compared with 1935.†

Of the March imports 57 per cent. were consigned to Singapore, 15 per cent. to Penang, 5 per cent. to Malacca, 21 per cent. to the Federated Malay States, and 2 per cent. to the Unfederated Malay States. Of the total, 66 per cent. were from Siam, 27 per cent. from Burma, 5 per cent. from French Indo-China, and 2 per cent. from other countries.

Of the exports during March, 76 per cent. were consigned to the Netherlands Indies, and 24 per cent. to other countries. The various kinds of rice exported were (in tons, percentages in brackets):—Siam 9,861 (71.5), Burma 2,873 (20.8), French Indo-China 456 (3.3), parboiled 517 (3.8), local production 78 (0.6).

India and Burma.—Foreign exports during January and February totalled 177,000 tons, as compared with 296,000 in 1935, a decrease of 40.2 per cent. Of these exports, 5.1 per cent. were to the United Kingdom, 10.7 to the Continent of Europe, 44.1 per cent. to Ceylon, 23.7 per cent. to the Straits Settlements and the Far East, and 16.4 per cent. to other countries. The corresponding percentages during 1935 were 3.4, 5.8, 26.0 39.5 and 25.3.

Burma's total exports of rice and bran (*Bangkok Times*, 30th March, 1936) during January and February aggregated 608,113 metric tons, as compared with 705,750 metric tons in 1935, a decrease of 13.8 per cent.

Siam.—Exports of rice and rice products from Bangkok during February are provisionally given as 109,912 tons. The cumulative total is 249,361 tons as compared with 304,192 tons in 1935.

Japan.—According to the *Trans-Pacific Journal*, 12th March, 1936, Japan's actual rice crop for 1935 amounted to 8,058,482 tons, an increase of 10.8 per cent. when compared with 1934.

Stocks of rice in Japan on 1st March, 1936, were 6,121,560 tons. The supply during the remaining eight months of the rice year is estimated at 7,312,763 tons, with demand 6,072,931 tons, which will leave 1,239,832 tons to be carried over into the next rice year.

French Indo-China.—Entries of padi into Cholon during the first quarter of the year totalled 521,792 metric tons, as compared with 586,517 metric tons in 1935, a decrease of 11 per cent. Exports of rice for the same period decreased by 21.9 per cent. to 453,267 metric tons as against 580,351 metric tons in 1935.

* Abridged from the Rice Summary for February, 1936, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935.

Netherlands Indies.—The latest information available was published in the Summary for February 1936.

Ceylon.—Imports during the first quarter totalled 142,322 tons, as compared with 133,715 tons in 1935, an increase of 6.4 per cent.

Of these imports 10.9 per cent. were from British India, 66.7 per cent. from Burma, 0.2 per cent. from the Straits Settlements, and 22.2 per cent. from other countries. The 1935 corresponding percentages were 10.4, 73.1, 1.3 and 15.2.

Europe and America.—Shipments to Europe from the East during the period 1st January to 13th March aggregated 142,714 tons, as compared with 116,448 tons in 1935, an increase of 22.6 per cent. Of these, 49.5 per cent. were from Burma, 39.5 per cent. from Saigon, 8.4 per cent. from Siam, and 2.6 per cent. from Bengal. The corresponding percentages for 1935 were 63.1, 23.0, 11.2 and 2.7.

Shipments for the Levant from the 1st January to 25th February were 2,771 tons, a decrease of 79.4 per cent. and to Cuba, West Indies and America from 1st January to 11th March totalled 30,734 tons, a decrease of 11.6 per cent.

MALAYAN AGRICULTURAL EXPORTS, MARCH, 1936.

PRODUCT.	Net Exports in Tons				
	Year 1935	Jan.-March 1935	Jan.-March 1936	March 1935	March 1936
Arecanuts ...	21,588	6,813	7,893	3,189	2,074
Coconuts fresh † ...	106,272†	22.825†	26,364†	8,080†	8,852†
Coconut oil ...	35,911	7,271	10,398	2,706	3,779
Copra ...	111,752	30,366	17,040	7,276	8,107
Gambier, all kinds ...	2,837	672	516	250	101
Oil cakes ...	11,361	2,235	2,955	265	1,398
Palm kernels ...	3,892	825	983	460	401
Palm oil ...	24,996	4,423	4,400	1,247	1,062
Pineapples canned ...	73,923	14,874	15,707	5,250	4,175
Rubber ¶ ...	378,381¶	96,788¶	83,999¶	29,658¶	23,400¶
Sago,—flour ...	10,920	3,726	458*	1,020	843
,, —pearl ...	4,655	1,110	707	321	248
,, —raw ...	7,735*	1,723*	2,073*	583*	738*
Tapioca,—flake ...	1,953	504	500	108	178
,, —flour ...	755*	335*	429*	220*	155*
,, —pearl ...	17,169	2,994	3,055	983	1,111
Tuba root ...	567	133½	188½	3*	71½

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION (IN TONS) OF PALM OIL AND KERNELS

(As declared by Estates)

Month 1936	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S.
January ...	1,395.4	326.5	258.6	37.2
February ...	1,531.9	372.4	244.2	54.6
March ...	1,878.4	534.5	302.9	88.0
Total ...	4,805.7	1,233.4	805.7	179.8
Total January to March 1935 ...	3,144.0	894.4	508.3	136.7
Total for year 1935 ...	17,338.7	5,764.6	2,711.1	818.4

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 31ST MARCH, 1936.

State or Territory	Acreage of Tappable Rubber end 1934	Estates which have entirely ceased tapping		Estates which have partly ceased tapping (a)		Area of Tappable Rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,691	1,947	4.4	15,884	35.5	725	1.6	17,831	39.9
Malacca	123,793	3,087	2.5	34,582	27.9	3,412	2.8	37,669	30.4
Penang Island	2,593	130	5.0	489	18.9	254	9.8	619	23.9
Singapore Island	33,312	3,793	11.4	10,006	30.0	417	1.3	13,799	41.4
Total S.S. ...	204,389	8,957	4.4	60,961	29.8	4,808	2.4	69,918	34.2
FEDERATED MALAY STATES :—									
Perak	295,895	19,016	6.4	70,959	24.0	14,531	4.9	89,975	30.4
Selangor	345,100	13,333	3.9	76,599	22.2	17,066	4.9	89,932	26.1
Negri Sembilan	258,381	14,998	5.8	54,750	21.2	17,222	6.7	69,748	27.0
Pahang	75,912	11,518	15.2	27,066	35.6	18,561	24.5	38,584	50.8
Total F.M.S. ...	975,288	58,865	6.0	229,374	23.5	67,380	6.9	288,239	29.5
UNFEDERATED MALAY STATES :—									
Johore	417,633	21,544	5.2	68,734	16.4	43,698	10.5	90,278	21.6
Kedah	199,180	3,880	1.9	22,423	11.3	19,349	9.7	26,303	13.2
Kelantan	28,891	403	1.4	12,489	43.2	7,688	26.6	12,892	44.6
Trengganu (b)	4,643	Nil	Nil	15	0.3	179	3.9	15	0.3
Perlis (c)	1,206	Nil	Nil	653	54.1	59	4.9	653	54.1
Brunei	(d) 4,991	Nil	Nil	1,616	32.4	856	17.2	1,616	32.4
Total U.M.S. ...	656,544	25,827	3.9	105,930	16.2	71,829	10.9	131,757	20.1
TOTAL MALAYA ...	1,836,221	93,649	5.1	396,265	21.6	144,017	7.8	489,914	26.7

Notes :—(a) Area out of tapping on Estates which have partly ceased tapping refers tc areas definitely being rested and excludes areas on any tapping round.
(b) Registered Companies only.
(c) Rendered quarterly.
(d) Acreage of tappable rubber on 1st May, 1934.

MALAYAN RUBBER STATISTICS TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF MARCH, 1936, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January and Feb. 1936		during the month		January and Feb. 1936						
	Ports	Dealers	Estates of 100 acres and over	during the month	January and Feb. 1936	during the month	January and Feb. 1936	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January and Feb. 1936
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES:—																				
Federated Malay States ...	...	7,262	12,088	8,572	28,830	3,789	14,796	Nil	Nil	Nil	Nil	11,472	2,376	32,791	11,483	...	5,224	12,631	8	21
Johore ...	...	2,091	4,125	3,560	11,761	1,511	8,023	Nil	40	Nil	98	2,403	3,209	6,428	13,593	...	1,599	4,116	...	...
Kedah ...	...	220	3,074	2,029	7,726	352	1,481	Nil	Nil	Nil	Nil	1,238	1,041	3,823	5,553	...	124	3,272	...	...
Perlis ...	...	12	17	8	33	5	57	Nil	Nil	Nil	Nil	Nil	18	Nil	90	...	4	20	...	...
Kelantan ...	...	309	309	242	828	373	1,490	Nil	Nil	Nil	Nil	137	442	416	1,799	...	271	383	...	...
Trengganu ...	...	55	50	317	696	159	349	Nil	Nil	Nil	Nil	Nil	476	Nil	1,045	...	55	50	...	...
Brunei ...	...	17	39	37	137	27	161	...	...	...	...	...	71	...	302	...	3	46	...	...
Total Malay States	...	9,966	19,702	14,765	50,011	6,216	26,357	Nil	40	Nil	98	15,250	7,633	43,458	33,865	...	7,280	20,518	8	21
S. SETTLEMENTS:—																				
Malacca ...	...	1,758	1,203	884	3,001	461	1,669	Nil		Nil		2,542		7,077		...	1,409	1,269	...	...
Province Wellesley	...	772	497	306	1,146	172	635	Nil		Nil		8,219		24,181		...	480	571	...	...
Penang ...	2,696	6,020	10	15	49	168	265	2,825	9,496	8,415	32,774		Nil		Nil	1,500	4,968	6	...	...
Singapore ...	4,739	24,966	186	127	438	266	379	9,161		34,817		20,541		49,373		3,565	19,289	162	21	64
Labuan ...	...	15	Nil	Nil	Nil	20	49	40		233		Nil		Nil		...	28	Nil	...	...
Total Straits Settlements ...	7,435	33,531	1,896	1,332	4,634	1,087	2,997	12,026	9,496	43,465	32,774	31,302	Nil	80,631	Nil	5,065	26,174	2,008	21	64
Total Malaya ...	7,435	43,497	21,598	16,097	54,645	7,303	29,354	12,026	9,536	43,465	32,872	43,552	7,633	124,089	33,865	5,065	33,454	22,526	29	85

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	4,517	18,545	4,574	1,716	1,476	63
WET RUBBER	707	744	394	204	123	61
TOTAL ...	5,224	19,289	4,968	1,920	1,599	124

TABLE III
FOREIGN EXPORTS

PORTS	For month	January and Feb. 1936
29	30	31
Singapore ...	30,989	76,893
Penang ...	10,976	33,023
Port Swettenham.	4,326	13,494
Malacca ...	261	679
MALAYA ...	46,552	124,089

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January and Feb. 1936
32	33	34
Malay States ...	22,883	77,323
Straits Settlements	2,370	[illegible]
MALAYA ...	25,253	84,662

Notes:—
1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23 April, 1936.

METEOROLOGICAL SUMMARY, MALAYA, MARCH, 1936.

Locality.	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B.	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total.	Total.	Most in a day. Amt.	Number of days: Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total.	Daily Mean.	Per cent.
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	92.0	71.9	81.9	96	68	85	75	84.8	85.2	12.41	315.2	3.85	14	11	3	7	1	206.10	6.65	55
Bukit Jeram, Selangor ...	88.2	72.5	80.3	91	70	80	75	84.1	86.0	12.87	326.9	3.09	15	13	2			215.25	6.94	57
Sitiawan, Perak ...	88.9	73.3	81.1	92	70	81	76	83.4	84.0	6.66	169.2	1.94	18	14	1	2		196.35	6.33	53
Temerloh, Pahang ...	87.5	71.8	79.7	92	68	78	75	84.1	85.2	8.80	223.5	2.08	20	16		6		170.80	5.51	45
Kuala Lipis, Pahang ...	88.5	71.2	79.9	92	66	78	74	83.3	84.0	7.60	193.1	1.70	16	15		21		178.00	5.74	47
Kuala Pahang, Pahang ...	84.6	74.1	79.3	88	70	78	77	82.8	84.2	20.51	520.9	4.00	25	20			1	177.70	5.73	47
Kallang Aerodrome, S'pore ...	86.7	74.8	80.7	92	72	80	77	82.2	83.6	7.77	197.4	1.48	15	13	13			167.75	5.41	45
Butterworth, Province Wellesley ...	89.0	73.4	81.2	92	70	85	76	86.0	86.0	7.58	192.5	2.27	16	14		1	1	234.50	7.56	63
Bayan Lepas Aerodrome Penang ...	88.8	73.1	80.9	93	69	84	76	84.6	84.9	7.00	177.8	1.79	18	18	7		1	239.05	7.71	64
Bukit China, Malacca ...	88.8	73.5	81.1	93	71	83	75	84.1	84.9	8.27	210.1	1.65	15	13	3		1	205.55	6.63	55
Kluang, Johore ...	87.0	71.3	79.1	92	66	79	73	81.2	81.8	8.13	206.5	1.29	20	17	1	10		159.35	5.14	42
Bukit Lalang, Mersing, Johore	83.6	73.2	78.4	86	68	77	79	80.8	80.9	21.92	556.8	4.07	23	19				168.45	5.43	45
Alor Star, Kedah ...	92.2	71.2	81.7	95	65	86	74	84.6	85.1	9.47	240.5	2.46	13	12	8	1		243.00	7.84	65
Kota Bahru, Kelantan ...	86.8	72.8	79.8	90	68	79	75	82.5	83.3	5.19	131.8	1.02	20	18	1	1		210.80	6.80	57
Kuala Trengganu, Trengganu	86.1	72.9	79.5	89	68	76	76	82.7	83.7	12.27	311.7	3.43	27	24		2	1	206.50	6.66	55
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	71.7	61.7	66.7	75	59	64	64	72.5	72.1	8.00	203.2	1.26	24	23		24		165.20	5.33	44
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	73.3	56.0	64.7	77	44	65	63	69.0	69.1	5.46	138.7	0.93	13	12				161.00	5.19	43
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.8	58.7	65.3	76	56	63	61			5.56	141.2	0.99	13	13	2		2	173.35	5.59	46

Compiled from Returns supplied by the Meteorological Branch, Malaya

NOTICE.

Department of Agriculture, S.S. and F.M.S.

The Adviser on Agriculture invites those interested to visit the Central Experiment Station and the School of Agriculture, Serdang, and also the other Experiment Stations, Agricultural Stations, Farm Schools, Padi Experiment Stations, and Padi Test Stations of the Department in various parts of the Straits Settlements and Federated Malay States.

Agricultural Stations and Padi Test Stations also exist in certain of the Unfederated Malay States, to which visits are welcomed by the State authorities.

Intending visitors to the Central Experiment Station should communicate with the Senior Assistant Agriculturist in charge, and to the School of Agriculture with the Principal.

The Central Experiment Station and the School of Agriculture are situated about fourteen miles by road from Kuala Lumpur and three miles from Serdang Railway Station where cars can be hired. Visitors' days at the Experiment Station are the first and third Wednesdays in each month.

Other Stations are listed below together with the addresses of officers to whom enquiries should be sent.

Experiment Station, Tanah Rata, *Agricultural Officer, Cameron Highlands.*

Coconut Experiment Station, Klang, *The Agriculturist, Department of Agriculture, Kuala Lumpur.*

Pineapple Experiment Station, Lim Chu Kang, Singapore, *Agricultural Officer, Singapore.*

Titi Serong Padi Experiment Station, *Agricultural Officer, Krian.*

Talang Padi Experiment Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*

Pulau Gadong Padi Experiment Station, *Agricultural Officer, Malacca.*

Dairy Farm, Fraser's Hill, *Manager.*

Bukit Mertajam Agricultural Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Selama Agricultural Station, *Agricultural Officer, Krian.*

Kuala Kangsar Agricultural Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*

Cheras Agricultural Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*

Rembau Agricultural Station, *State Agricultural Officer, Negri Sembilan, Seremban.*

Kuala Pilah Agricultural Station, *State Agricultural Officer, Negri Sembilan, Seremban.*

Sungei Udang Agricultural Station, Farm School, and Padi Test Station, *Agricultural Officer, Malacca.*

Kuala Lipis Agricultural Station, *State Agricultural Officer, Pahang, Kuala Lipis.*

Temerloh Agricultural Station, *Malay Agricultural Officer, Pahang South, Temerloh.*

Kuantan Agricultural Station, *Malay Agricultural Officer, Pahang East, Pekan.*

Pekan Agricultural Station and Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*

Ayer Itam Agricultural Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Raub Agricultural Station, *State Agricultural Officer, Pahang, Raub.*

Telok Datoh Agricultural Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*

Labuan Agricultural Station and Padi Test Station, *Agricultural Officer, Singapore.*

Kuala Kurau Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Bagan Serai Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Briah Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Selinsing Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Bukit Gantang Padi Test Station, *State Agricultural Officer, Perak, Taiping.*
Lenggong Padi Test Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*
Bruas Padi Test Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*
Sungei Manik Padi Test Station, *Agricultural Officer, Perak South, Teluk Anson.*
Panchang Bedena Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Sungei Haji Durani Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Tanjong Karang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kuang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kajang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kuala Klawang Padi Test Station, *State Agricultural Officer, Negri Sembilan,* Seremban.
Ampang Tinggi Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
Kendong Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
Dong Padi Test Station, *State Agricultural Officer, Pahang, Raub.*
Kuala Lipis Padi Test Station, *State Agricultural Officer, Pahang, Raub.*
Kerdau Padi Test Station, *Malay Agricultural Officer, Pahang South, Temerloh.*
Bawang Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
Pekan Padi Test Station,*Malay Agricultural Officer, Pahang East, Pekan.*
Sungei Blat Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
Glugor Padi Test Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*
Bukit Merah Padi Test Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Unfederated Malay States.

Central Experiment Station, Ayer Hitam, Johore, *Agricultural Officer, Johore Central, Kluang.*
Tangkah Agricultural Station, *Agricultural Officer, Johore North, Muar.*
Gaja Mati Agricultural Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Central Experiment Station, Kota Bharu, Kelantan, *State Agricultural Officer, Kelantan, Kota Bharu.*
Kilanas Agricultural Station and Padi Test Station, Brunei, *Agricultural Officer, Singapore.*
Tangkah Padi Test Station, *Agricultural Officer, Johore North, Muar.*
Jimentah Padi Test Station, *Agricultural Officer, Johore North, Muar.*
Tenglu Padi Test Station, *Agricultural Officer, Johore Central, Kluang.*
Telok Chengai Padi Experiment Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Langgar Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Jitra Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Rantau Panjang Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Pulai Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Sala Kanan Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Pasir Puteh Padi Test Station, *State Agricultural Officer, Kelantan, Kota Bharu.*
Seriab Padi Test Station, *Adviser, Perlis, Kangar.*
Kampong Salang Padi Test Station, *Adviser, Perlis, Kangar.*
Lumapas Padi Test Station, Brunei, *Agricultural Officer, Singapore.*

DEPARTMENT OF AGRICULTURE, S.S. & F.M.S.

Agricultural Leaflet No. 11.

GAMBIER

(UNCARIA GAMBIR)

Published by the Department of Agriculture, Straits Settlements and Federated Malay States, Kuala Lumpur, F.M S. and Printed by Caxton Press Ltd., Kuala Lumpur.
May, 1936.

GAMBIER

(Uncaria gambir)

Description.—The gambier plant is a semi-climbing woody shrub, from which gambier of commerce is obtained as an astringent extract from the leaves and shoots. Gambier is a tanning material, and colour mordant in the dyeing-industry; it is also extensively used as a masticatory throughout the Orient. The astringency is due to the large amount of catechin and catechu-tannin contained in the leaves and twigs of the plant. Gambier is usually prepared and sold as "bale" or "cube", the latter containing about one quarter the moisture of the former and, in consequence, commanding a higher price. When prepared for chewing with betel-leaf and lime, gambier is commonly mixed with rice-bran, and cut into small square wafers. Good gambier is an earthy-looking substance of a light yellowish colour, but oxidizes to a darker colour on exposure to the air; this is shown on the outside of the cubes or bales.

Soil and Situation.—Although the gambier plant is not fastidious as to soil, it succeeds best when planted on well-drained virgin land. It makes little progress on land holding stagnant water. Gambier is a sun-loving plant and ceases to thrive when shaded from direct sunlight. It demands a heavy and evenly distributed rainfall, and grows exceedingly well on the plains in Malaya.

Cultivation.—Gambier is one of the few crops that produce quick returns, while its planting and manufacturing costs are low. It was grown in the past mainly as an inter-crop with young rubber, and many Chinese-owned rubber estates were brought into bearing by this means. The large amount of fuel required in boiling has always limited gambier plantations to areas not far removed from the jungle. Production in Malaya has decreased during recent years owing to the cessation of rubber planting, combined with an unsteady market and low prices. Trials at the Central Experiment Station, Serdang, of gambier as an inter-crop with oil palms were not an unqualified success, as the oil palms at two years had a leaf spread and development which caused severe competition between the two crops, so that the period of cropping of the gambier was insufficient to give profitable returns. Although at the present time (May, 1936) gambier cultivation is considered a paying proposition by Chinese growers, there is little inducement to plant it, because new land for rubber planting is unobtainable owing to the International Rubber Agreement.

Insufficient information is available as to costs of production of gambier as a sole crop, and for this reason its cultivation under present conditions cannot be recommended. Trials as a sole crop have been in progress at Serdang for two years and it is hoped to make further information available in due course. What is known is now recorded in this leaflet. Gambier has been grown in Sumatra for some years as a sole crop where a superior product is prepared by special machinery and commands a price out of all relation to ordinary "cube" or "bale" gambier. The crop is productive for twelve to eighteen years following planting on newly-cleared jungle land. The maximum yield is stated to be obtained between the 7th and 12th years. Crop yields might be increased and maintained for a longer period, by the use of suitable fertilizers. Gambier is an exhausting crop, due to the large amount of plant nutrients removed from the land by continuous cropping.

Seed and Nurseries.—Gambier is propagated from seed, and great care is necessary to gather mature capsules as soon as they show signs of splitting. The capsules are dried on a mat, when they dehisce and liberate the seeds. The seeds are minute, winged at each end, and produced in great abundance, each capsule containing 100 or more seeds. Since the seeds rapidly lose their power of germination after ripening they should be sown as soon as possible after collection. Chinese growers state that one picul (133 1/3 lbs.) of seed will produce sufficient seedlings to plant 100 acres of land. This statement must, however, be accepted with reserve, since the degree of purity of the seed will depend upon the amount of husk remaining in the sample after drying and winnowing.

The seed is sown in shaded nursery beds of fine soil with a fair proportion of humus. It is advantageous to mix the seed with sand in order to secure even distribution. After sowing, a slight consolidation of the surface soil and watering with a fine spray will be sufficient to wash the seed into the soil. Germination commences in ten days from sowing and great care is then necessary in watering to prevent disturbance of the young plants before they are securely anchored to the soil. The seedlings require shade and a moist atmosphere during the early stages of growth. Before transplanting, the seedlings should be hardened off by the partial removal of the overhead shade but they should be protected against direct sunlight, otherwise the tender foliage may become scorched. Self-sown seedlings are often obtained in the field and used as planting material.

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Transplanting.—The young plants should be about 3 inches high in four to six months from sowing, at which stage they may be transplanted into the field. This operation is carried out during late March and April or October and November, that is to say, during the rainy seasons. Sufficient seedlings should be retained in the nursery beds for future supplying. The usual planting distance is 6 feet by 6 feet apart which gives 1,210 plants per acre. Planting distances vary somewhat, depending to a large extent upon the spacing of the main crop. As an inter-crop, three rows of gambier are usually planted between the rows of rubber. The method of planting adopted by the Chinese is to dig circular holes about 6 inches deep and plant the seedlings immediately on the sides of the holes, which are left open until the plants are established. A piece of palm frond is placed across the top of the hole in order to keep the direct rays of the sun from the young plants. This system proved very successful at the Central Experiment Station, Serdang, and resulted in a good stand of plants. Transplanting should only be undertaken when there are signs of rain and never attempted during the dry seasons. On Chinese estates, beyond ordinary surface weeding little or no cultivation is undertaken. Careful supplying during the planting season following transplanting, and the subsequent replacing of dead or weakly bushes, is necessary to obtain satisfactory yields. The use of leguminous green manures and nitrogenous fertilizers is not undertaken by Chinese growers in Malaya, and it is difficult to say whether returns would justify any such additional outlay.

Harvesting.—In about twelve to fifteen months after planting in the field the first crop is ready for cutting. The crop consists of the leaves and green shoots that develop as laterals to the main stems; the latter are not pruned unless they exceed 6 feet in height. In Malaya, a small amount of twigs is often included with the leaves and shoots. Young leaves and shoots are relatively richer in catechin than old ones and consequently the best gambier is obtained from the youngest growths. Immediately the plants flower production falls considerably. After plucking, the leaves and young shoots must be removed to the boiling pans as quickly as possible, as rapid deterioration sets in after the foliage is removed from the bushes. Experiments have shown that an interval of four months between cropping gave the highest yield of prunings which contained the greatest percentage of gambier. This period of pruning was compared with intervals of three and six months. It is uncertain, however, whether cropping might be

undertaken continuously every four months over a long period without undue strain of renewal upon the plants. At four months the prunings should be about 1 to $2\frac{1}{2}$ feet long, depending on weather conditions and the fertility of the land. Formerly, the leaves and twigs were transported to the factory in rattan baskets, but in many instances these have been superseded by a looped rope with a wooden hook at one end. The gambier twigs are tightly bound with this rope and carried on poles to the factory.

Manufacture.—The factory for the preparation of gambier as undertaken by Chinese is usually built of round timber, with open sides, and earth floor. It is placed near a stream thus ensuring a supply of water for boiling operations. A site on sloping land is generally selected, as this facilitates both easy construction of the furnace and boiling pans, and, later, working operations. The roof, which rises steeply and may end in an apex 30 feet from the ground, is thatched with *attap*. A series of rafters is fixed above the cauldrons, for use as drying racks for the prepared gambier to accelerate drying. The furnace is usually an excavation in the floor, with walls consisting of beaten clay. An extension of the furnace front provides a suitable place for stacking timber for use as fuel. The iron boiling pans vary in size and number and are sunk in the floor above the furnace. In order to increase the capacity of the cauldrons, the sides are extended with wooden staves, forming a funnel 4 feet high. Behind the boiling pan and sloping towards it is a large trough, some 15 to 20 feet in length, consisting of half a hollowed-out tree trunk.

The freshly-cut leaves and stems are cut into lengths of about 5 to 6 inches and put into boiling water in the pan, and the whole constantly stirred with large wooden five-pronged forks for about one hour. About 2 piculs (267 lbs.) of prunings are placed in a cauldron containing 80 gallons of water, which is eventually reduced by boiling to 12 gallons of gambier extract. In the process of boiling the leaves are broken up and assume a yellowish appearance. The prunings are removed from the pan and placed on the wooden trough, in order that the drainage may flow back to the pan. The prunings are then washed with cold water until the liquid draining from the trough appears almost clear. A second boiling of the prunings is commonly undertaken, the extract either being treated separately as in the case of the first boiling, or a fresh supply of prunings may be added, depending upon the amount of crop available. The final washings are sometimes run into a storage pan in order that the following day's boiling may commence with charged water. A final skimming

is made with coarse-meshed sieves. The contents of the pan are then subjected to a further period of boiling, usually about three and a half hours, until the concentrated extract assumes a deep brown colour, and becomes syrupy. It is then removed from the pan and sieved into wooden tubs, and allowed to stand for some time in order to cool and solidify. Solidification is accelerated by stirring rapidly the cooling extract with a small cylindrical piece of wood. If "bale" gambier is required the extract is allowed to remain in the tubs until set, it is then removed, cut into blocks, and placed on racks to dry. When "cube" gambier is desired the liquid extract is poured from the tubs into shallow pans made from kerosene tins. The liquid is then allowed to cool thoroughly and when hard enough is removed and cut into small cubes. "Cube" gambier is partially dried in the sun for a day or two and subsequently stacked on rafters above the cauldrons for a week to ten days until sufficiently dry for packing. Cubes dried in this manner commonly present a very dirty appearance due to the smoke and soot from the furnace. The smoking of cubes is not essential in manufacture, but assists greatly in retarding the formation of moulds, which occur owing to the high water content of the gambier. The dry gambier is packed either in bamboo baskets or rice sacks. The moisture content of the marketed product is found to vary from 10 to 15 per cent. for "cube" and up to 60 per cent. for "bale" gambier. When making squares for chewing, the extract is mixed with finely prepared rice bran in the proportion of 8 to 10 kati (10 to 13 lbs.) of bran to three half-kerosene tins (72 lbs. or 54 kati) of the extract. After the compound is solidified it is cut into bars 2 inches by 2 inches square and later sliced into thin wafers which are sundried for a week. This product together with a small amount of "cube" gambier is sold for local consumption.

Little information is available as to the preparation of gambier in Sumatra on estates under European management. It is stated, however, that the leaves and twigs are exhausted in cylinders by diffusion, the amount of heat and water being carefully controlled. The extract is concentrated *in vacuo*, and pressed block gambier of a standard quality is prepared. The period of extraction is stated to be eighteen to twenty-four hours.

Yields.—The young twigs and leaves contain about 7 per cent. of moisture-free gambier. With regular prunings from plants grown on good land by Chinese, a yield of 8 to 10 piculs (1 picul = 133 1/3 lbs.) of dry gambier is obtained per acre per annum. Lower yields are frequently recorded, especially when the gambier

plants are shaded by the main crop. As a plantation crop in Sumatra, yields as high as 20 piculs per acre per annum are said to be obtained.

Labour and General Considerations.—The labour required over fair-sized Chinese holdings for harvesting, manufacture, and packing is about one labourer for 2½ acres per month, so that with intervals of four months between harvesting, one labourer for each 10 acres should be sufficient if continually employed. Upkeep requires about an equal amount of labour when gambier is an inter-crop; as a sole crop with improved cultural methods, labour charges would be considerably higher. Transport costs are reduced by building the boiling shed adjacent to the planted area. A feature of importance in the estimates of the cost of production is a regular supply of firewood for the factory. The present export duty on gambier from the Federated Malay States is 15 cents per picul.

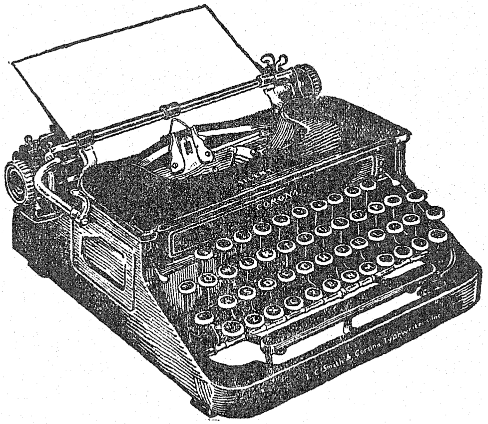
References.—Articles containing information on gambier are obtainable post free from the Agricultural Economist and Editor, Department of Agriculture, S.S. and F.M.S., Kuala Lumpur.

Gambier. Its Extraction and Valuation. *Malayan Agricultural Journal,* Vol. XIV, No. 2, price 50 cents.

Gambier, Production and Marketing. *Malayan Agricultural Journal,* Vol. XIV, No. 2, price 50 cents.

Gambier as a Catch-Crop with Oil Palm. *Malayan Agricultural Journal,* Vol. XVII, No. 11, price 50 cents.

Gambier as a Catch-Crop with Oil Palm. *Malayan Agricultural Journal,* Vol. XIX, No. 8, price 50 cents.



ERRATA.

Rice in Malaya in 1935.

Malayan Agricultural Journal, Vol. XXIV No. 2, February, 1936.

p. 47. line 8, "5,176 tons" should read "4,571 tons".

p. 47. under the sub-title "Area Planted", it is stated that little damage was occasioned by floods to padi crop in the riverine mukims of Perak. The facts are that the damage was such that only 1,099 acres out of 1,942 acres planted were reaped, and planters were so short of seed for planting in the 1935-36 season that large distributions of seed had to be made.

p. 57. Table VII. For "M.E. 88" read "M.E. 80," and for "M.E. 80" read "M.E. 88".

p. 60. 13th line up, last word on line "Mayang" should read "Machang".

p. 63. Table XIII Square C, Machang (local) "30.8 lbs." should read "30.1 lbs."

p. 64. Table XIV Squares A and B combined, S.K. 371 "21.3 lbs." should read "23.1 lbs."

p. 87. Line 8, *Disposal of Straw* "(b) straw burnt at *menajak*" should read "straw spread at *menajak*".

THE

Malayan Agricultural Journal.

JUNE, 1936.

EDITORIAL.

Approved Fungicides.

The general prevalence during the last decade of Mouldy Rot disease of the renewing bark of rubber trees in Malaya naturally led to the introduction on the market of numerous preparations intended for its treatment and control. As little was known from practical experience of the efficiency of several of these preparations in destroying the causative fungus, or of their effect on the delicate renewing bark, it became desirable to devise a scheme by which they could be tested and approved for general use.

This number contains an account of the scheme devised by the Department of Agriculture and the Rubber Research Institute of Malaya for this purpose.

The scheme is designed to assist and protect both the manufacturers of fungicides and the rubber planters. The fact that over forty fungicidal preparations have been tested is proof that manufacturers have taken full advantage of the facilities offered; while, as only a small proportion of such preparations successfully passed the tests, it is obvious that planters have received a valuable measure of protection against unsuitable preparations.

It is not to be inferred that the proprietors of the unsuitable products had imposed, or were intending to impose on the public; it merely means that a fungicide which is suitable for other purposes may be unsuited for the treatment of this particular disease. Further, it is necessary to point out that fungicides which have been placed on the "White List" for Mouldy Rot treatment are not necessarily suitable for other diseases of the rubber tree.

Another most important aspect of these tests is to decide on the optimum dilution of the fungicide. In view of the fact that the preparation is applied to the delicate cambial tissues exposed by the tapping process, it is essential that its concentration should be no greater than is necessary to destroy the fungus without damaging the renewing bark. The author points out that fungicides which cause bark-burning at or near the strength required for killing the mould are regarded as unsuitable, and this has been the chief reason for rejection of many proprietary products.

Every effort has been made to encourage the use of approved fungicides by small-holders. Arrangements have, in most cases, been made to ensure that such

fungicides are on sale at Asiatic shops frequented by owners of small areas of rubber; in addition, fungicides may be purchased at the offices of the Field Branch of the Department of Agriculture throughout the country.

The scheme has succeeded in making available several fungicides which, if applied as and when recommended, can be relied upon to effect control of the disease within a period of one month.

Experiments with Derris.

Considerable attention continues to be directed to the subject of derris by would-be planters and by those concerned with the trade in the dried root. An article on this subject was published in this Journal in October 1935 which summarized the information available at that time, and which referred the reader to the available literature on the subject.

Many points of importance regarding the toxic properties of the varieties and the cultivation of the crop remain unsolved, and are the subjects of further work in which the Chemical and Agricultural Divisions of the Department are closely collaborating. The first-fruits of this collaboration will be found in the article in this number which deals with varietal and manurial trials with derris. This is the first of three articles to be published in this place; the subsequent contributions to this subject will deal with preliminary selection experiments with derris, and with the present standards of Malayan derris.

In the present article, the authors shew that very considerable amounts of plant nutrients are removed from the soil by a crop of derris, and point to the necessity of manuring if the land is to be kept continuously under cultivation with this crop. Pursuing this line of investigation it is shewn that manuring and liming gave increased crops.

Finally, the authors show that whereas toxicity is not markedly affected by change of environment, there is, however, a variation between individual plants in consequence of which planting material should be taken from a wide range of plants.

In the past, fears have been expressed that the high toxic properties of plants cultivated in one district could not be maintained with a change of environment. The results of the present work will allay these apprehensions.

Effect of Salt Water on Padi.

We include a short note on the effect of irrigation of padi with salt water which is the first of a series of interesting pot experiments dealing mainly with the manuring of this crop. Other papers in the series will be published in subsequent numbers of this Journal.

The object of the present experiment was to obtain information on the amount of salt which padi can withstand, a subject of importance as the irrigation water for padi areas near the sea is sometimes contaminated with sea-water. The results shew that this crop is unlikely to withstand much over 2 per cent. concentration of salt for a lengthy period.

THE F.M.S. GOVERNMENT SCHEME FOR THE TESTING AND APPROVAL OF FUNGICIDES FOR THE TREATMENT OF MOULDY ROT ON RUBBER TREES

BY

F. BEELEY, B.SC.,

Pathologist, Rubber Research Institute of Malaya.

The discovery of Mouldy Rot disease (*Ceratostomella fimbriata*) of the tapping panel of rubber trees in 1916 presented to plant pathologists a unique problem in that the plant tissues affected by the disease were as delicate, if not more so, than the fungus which caused the disease.

It was early discovered that the delicate cambial tissues exposed by the tapping process were particularly sensitive to the contact of minerals or liquid sprays containing dissolved mineral salts. The use of organic compounds, represented by such proprietary tar-acid mixtures as Jodelite, Dougalite, Solignum, Noxo, Brunolinum and Coal tar, normally used for the preservation of structural timber, was investigated and it was found that, when applied neat, they caused considerable damage to the tapped surface of the tree so that weaker mixtures made by emulsifying these products in water with soap became the vogue. Proprietary preparations of emulsified tar oils under various names were soon available on the Malayan market.

The Rubber Growers' Association in their Third Malayan Report for 1919 issued a report upon tests of a number of various fungicides carried out by Sanderson and Sutcliffe. It was pointed out that laboratory tests on the strength of fungicides required to kill the Mouldy Rot and Black Stripe fungi bear no relation to the strength of the same fungicide required for use in the field. This report included the following thirteen desirable points in regard to fungicides:—

1. Its use should be possible in strength sufficient to kill or prevent the development of the particular organism against which it is used.
2. The planter should be able to tell by a glance that the substance has been applied.
3. It should not have a deleterious effect on the finished rubber.
4. It should not burn the tissue.
5. The penetrative power should be sufficient to be effective but not sufficient to cause wounds. (The thickness of the bark when the application is made is an important factor here).
6. The application should be simple and rapid, entailing a minimum of expense.
7. The planter should be able to rely on different samples being of constant composition or very nearly so; this applies more particularly to liquids which are used undiluted and which penetrate deeply.

8. The preparation must be easy to handle.

9. Its use must be possible daily (applies especially to liquids used as daily wash) without injurious effect on bark or wood.

10. If used in considerable dilution it is better if miscible with water.

11. It should not coagulate latex.

12. The initial cost must be reasonably low.

13. Re (12) if the initial cost is high this may be counter-balanced if the preparation can be used with effect in more dilute mixture than a cheaper preparation.

Further work on the control of Mouldy Rot is found in the Bulletins of the Department of Agriculture, Straits Settlements and Federated Malay States.

Sharples, Belgrave, Norris and Ellis in Bulletin 31 (1920) suggested the use of an emulsified form of Brunolinum known as Brunolinum Plantarium, while South and Sharples (1925) in Bulletin 37 pointed out the danger of bark damage from use of Jodelite or too strong mixture of Brunolinum and Tar or water-oil emulsions. They also stated that "laboratory tests carried out by testing cultures against percentage strength of disinfectants are useless and misleading when used as a basis for field tests". In this paper they gave an account of elaborate field tests carried out by the proprietors of the preparation "Agrisol" under the supervision of officers of the Department of Agriculture as a result of which the use of a 20 per cent. mixture of Agrisol in water was widely adopted for control of Mouldy Rot in Malaya. It was on the basis of these tests that Sharples formulated a scheme for the testing of all proprietary fungicides for use in control of Mouldy Rot with a view to providing a list of preparations which can be used with safety and give a high degree of efficacy.

It early became recognized that tests should be undertaken to provide an approved list of standard disinfectants for the treatment of this disease. The tests here discussed are concerned solely with reference to the treatment of Mouldy Rot disease of rubber and not for other rubber tree diseases.

Owing to the generally unsatisfactory position, particularly in regard to the supply of suitable fungicides to rubber small-holders, the Heads of the Pathological Divisions of the Department of Agriculture, S.S. and F.M.S., and Rubber Research Institute of Malaya agreed that standardization was not sufficient in itself and that controlled field tests were essential. Dr. Butler, Director of the Imperial Mycological Institute, London, was informed of this proposal in May 1930 and expressed his agreement with these views and mentioned that in Germany there was a scheme for field-testing of fungicides at several localities which if passed were included in a list of approved fungicides.

Later in the same year at an Inter-Departmental Conference at Kuala Lumpur it was suggested that proprietary disinfectants for treating plant diseases should conform to local Government standards. The details of methods to be followed in testing of common fungicides in Malaya were later drawn up and approved by the two Departments concerned. A scheme was then submitted to the Government,

Federated Malay States, and approved. As a result, the following notice was published in *The F.M.S. Government Gazette,* Vol. 23, No. 7, on 27th March, 1931.

"The attention of the Department of Agriculture has been directed to the necessity which exists for the standardization of disinfectants which are approved for use in the treatment of Mouldy Rot on rubber plantations.

2. From the date of this notice therefore in all notices served by the Department of Agriculture under the Plant Disease Prevention Ordinance for the treatment of Mouldy Rot only preparations will be specified which have been subjected to test by an approved authority and proved to be effective.

3. At present the list of such preparations includes:—

1. Agrisol.
2. Izal—in certain cases.

4. The Department will be prepared to extend the list to include any other preparations which have similarly been proved to be effective by approved authorities. It should be pointed out that certain other preparations in common use on estates have also been reported to give satisfactory results but, as these have not yet been subjected to systematic tests, they are not at present included in the list.

5. The approved authority for carrying out such tests for Malaya will be the Rubber Research Institute and the carrying out of such tests will in future be undertaken by the Rubber Research Institute: applications from proprietors of fungicides for the performance of such tests with a view to their inclusion in the list should be addressed to the Director of the Rubber Research Institute accordingly.

6. The tests will be made strictly in accordance with priority of receipt and also in accordance with the capacity of the Institute to deal with them when received.

7. All supplies of disinfectants required for such tests must be furnished without charge by the firms applying for such tests while the actual expenses involved in carrying out the tests must also be borne by the said firms.

8. For further information regarding tests application should be made to the Rubber Research Institute.

9. Proprietors of fungicides and their representatives in Malaya are further notified that preparations which, on samples supplied, have passed the tests prescribed by the Rubber Research Institute, will only be admitted to the list provided that the proprietors are willing and able to give a guarantee that the formula for the composition of their preparations will remain unchanged.

10. Should any proprietor of an approved fungicide desire to make any change in the composition of the fungicide he must notify the Director of Agriculture and submit samples of the preparation in its new form for further tests if required to do so. Failure to do this may entail the removal of an approved preparation from the list."

As part of the operation of the scheme it was agreed that a proprietor who wished to have his preparation tested should inform the Director, Rubber Research Institute of Malaya, from whom he would then receive a letter stating the conditions of the tests.

These conditions were based on the above Government Notification, but also made provision for the right of publication of the results by the Rubber Research Institute, whether or not the results were good. Furthermore, the applicant was informed that any complaints received by the Institute or Department of Agriculture respecting the White List would be referred to the Agents, and the receipt of more than three such complaints might, in the absence of a satisfactory explanation from the agents, entail the removal of the disinfectant from the List.

The cost of the test, to be borne by the proprietor, depended largely on the location of the test blocks. The outside estimate for a suitable test was $200, which sum was to be deposited with the Institute before the tests were undertaken.

Since the adoption of this scheme the Institute has tested over forty fungicidal preparations of which only a small proportion have successfully passed the tests and been approved for a place on the White List which at the present date is as follows:—

Name	Date gazetted F.M.S.	Concentration to be used
1. Agrisol	27. 3.31	15 to 25 per cent. in water
2. Izal	27. 3.31	3 to 5 per cent. in water
3. Black Cyllin	7. 6.32	5 to 10 per cent. in water
4. Killgerm	17. 6.32	5 to 10 per cent. in water
5. Kilsol Red	17. 6.32	5 to 10 per cent. in water
6. Brunolinum Plantarium	17. 6.32	10 to 15 per cent. in water
7. Agrisol White	6.10.33	10 to 15 per cent. in water
8. Cargillineum 'B'	28. 7.33	To be used neat
9. Durycolium	6. 5.36	To be used neat.

In this connexion it might be mentioned that a session of the Third Imperial Mycological Conference held in London in 1934 was devoted to a discussion on the "Methods of Standardization of Insecticides and Fungicides". An account of the opening speech quoted from the official report of the Conference reads as follows:—

> "Dr. Gussow (Canada) in introducing the subject gave an outline of the procedure adopted in Canada, the United States, and Germany. In Canada an Act for the regulation of the sale of fungicides was passed in 1927, the primary object of which was to prevent the sale of fraudulent products. All products have to be registered; the well-known and tested substances are granted registration immediately; those tested to a limited extent but known to be effective are allowed registration temporarily; for

those untested, experimental data are requested and tests arranged, whilst the worthless materials are refused. Applications for registration require to be accompanied by a fee of $20 gold, and the name and percentage of all ingredients have to be stated. Every registration expires on 31st December. In the United States similar control has been established. In Germany the procedure involved duplicated tests the data from which were referred to an official body, which rejects or permits the use of the material. The ingredients are either disclosed or communicated confidentially. The testing of fungicides by field tests gives the most satisfactory results, but it requires money and time, and it is very desirable that research should be undertaken in connection with the laboratory testing of such materials."

Mr. Sharples, who represented the Rubber Research Institute, gave an account of the testing of fungicides in Malaya which was very greatly appreciated by other delegates.

The following is an account of the laboratory work which led to the present method of field-testing of fungicides.

Proposed Tests for Fungicides.

1. *Microscopical.*—If in emulsion, globule size is of importance and it is found that the smaller the size of globule the greater the fungicidal effects, the more permanent the emulsion and the greater the ease of mixing with water. Large globules tend to coalesce easily to give an oily film detrimental to living plant tissues.

If in oil or paste form, the physical properties are noted for ease of use and covering power.

If in powder form, fineness and free-running, non-aggregating properties are noted.

Globule size for an emulsion is usually 1 to 2μ and not greater than 3μ-*i.e.* globules in continuous Brownian movement when in a water film. Fine powders should have the following particle sizes: Min. 3μ to 6μ, Bulk 12μ to 18μ, Max. 30μ. Larger particles, like grit, are considered unsatisfactory though a few large particles often assist in preventing aggregates and in maintaining free-running powder form, as all fine powders tend to aggregate on standing in bulk.

2. *Chemical.*—Examine chemically to determine the nature of the fungicide and its concentration from which the approximate strength for use in the field can be determined; *e.g.* a fluid which on treatment with 20 per cent. sulphuric acid shows a content of 40 to 50 per cent. of tar acids will probably be successful in the field at a concentration of 7 to 15 per cent. in water. If 90 per cent. tar acid is found, then a strength of about 3 to 5 per cent. will be necessary in the field.

If excess alkali or acid is present the product is likely to be detrimental to plant tissues.

Only one paste fungicide the composition of which was supplied by the makers has been tested.

3. *Penetration Tests on living Bark.*—The bark of a rubber tree is wounded to imitate light, medium and deep tapping over an area of bark of at least 6 x 2 inches and the fungicide is applied at various predetermined strengths to indicate (*a*) slight penetration of the bark (*b*) medium and (*c*) deep or harmful penetration and killing of the bark. The lethal strength is noted. Two to four days are usually sufficient to determine this factor.

Any damage done to the bark by volatile components or invisible fluids is often difficult to detect, but a good test is to make a knife-edge cut into the remaining bark across the wound and to note the condition of the latex or juice which flows out. A thin, almost colourless fluid indicates danger and it is often found that the cambium beneath is discoloured —being more sensitive to the gas or fluid—and slowly dies. A thin, milky fluid shows that the maximum concentration has been reached, while a thick, creamy latex indicates a healthy condition of the bark.

Surface effects on the bark are also noted, since a fluid which kills, shrivels and blackens the outer cells is hardly desirable, whereas some fungicides appear to improve the condition of the outer cells and actually improve the renewal of bark.

It should be noted that cells near the cambium are far more sensitive to fungicides than cells further out in the cortex. Therefore the test for a fungicide to be applied to the panel after tapping should only penetrate lightly on wounds made close to the cambial region.

On the outer, hard bark most of the fungicides may be used at higher concentrations without danger to the liner bark.

The visual penetration four days after application of the fungicide should be not greater than one millimetre, preferably less than a half millimetre.

The tests are carried out under reasonable shade, as direct sunlight on the wounded bark may cause considerable damage which may be erroneously attributed to the fungicide. Dark mixtures particularly, appear to penetrate more deeply on bark in sunlight than they do under shade, owing to the heat absorbing properties of the black surface.

The use of mixtures of fungicidal coal-tar oils in an asphalt-kerosene medium on the tapping panel has been abandoned on account of the great absorption of heat on the black surface during wintering which follows so quickly on the rainy Mouldy Rot season.

Laboratory Tests.

Much useful work has been done by various research institutions throughout the world to find a satisfactory laboratory method of determining the fungicidal, bactericidal or germicidal value of a preparation. None has yet been considered very satisfactory. Though the Rideal-Walker test has found considerable popularity as a means of determining bactericidal value it does not follow that the product

treated will give the same efficacy when used upon living plant or animal material. Recently a compound of high "R.W." coefficient proved useless as a fungicide on rubber trees whereas one of comparatively low "R.W." coefficient proved very efficient in control of Mouldy Rot.

It has been found that, with cultures of the Mouldy Rot fungus *Ceratostomella fimbriata* in agar medium, the strength of say a tar-acid emulsion required to kill the fungus was so low compared with that required in the field that no indication could be obtained from such culture tests which would enable the value of a specific compound for the purpose of control of Mouldy Rot or indeed any other disease of the tapping panel to be judged. It could be considered as giving merely a comparison of the lethal efficiency of the various compounds in that medium.

An alternative laboratory method was investigated. This consists of inoculating clean strips of living bark 6 x 1 x $\frac{1}{4}$ inch in sterile tubes with the Mouldy Rot fungus *Ceratostomella fimbriata*. The fungus is grown on the cambial side of the bark strip for seven days, after which it is found that the thick-walled resting spores are present in great numbers. The strips of bark are then immersed in beakers containing various strengths of the fungicide under test. Scrapings of the fungus and tissue are then taken from the strips of bark at short intervals, usually after immersion for 2, 5, 10, 15, 20, 25 and 30 minutes, and the scrapings are washed and inoculated into a tube or plate of nutrient agar.

This time-immersion method gives results considerably more comparable to the field tests than the Rideal-Walker test, but is still so inferior to the field-test method that it has been decided that the field-test should be considered the only suitable final test of the efficacy of a fungicide for the control of the disease.

Field Tests.

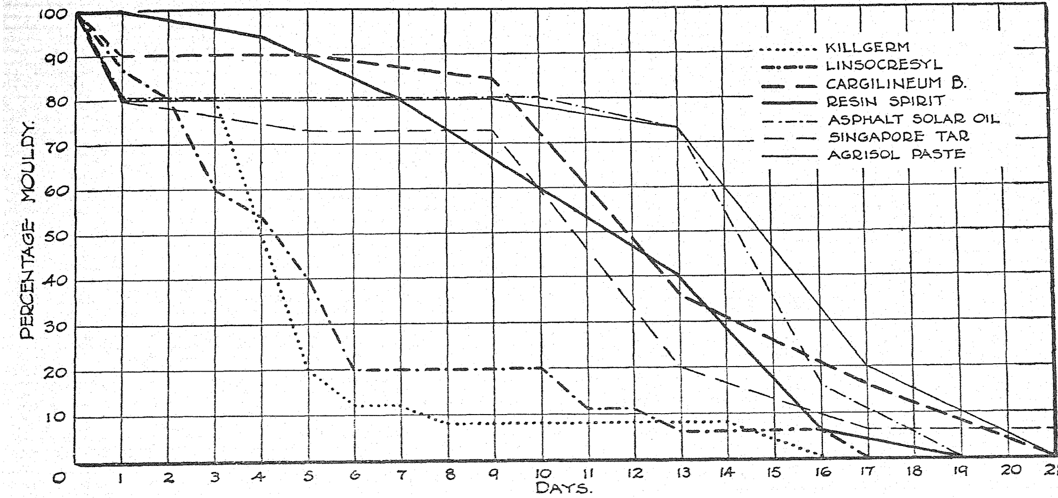
In carrying out field tests the following practice is adopted:

An area of rubber carrying a heavy infection of Mouldy Rot is selected at the most convenient distance from the laboratories.

Trees showing mouldy tapping panels are numbered by stencil and divided into plots of 25 trees, each having 100 per cent. infection. The condition of neighbouring fields of trees serves as control to indicate the normal progress of the disease when no treatment is given.

In the case of a tar-acid emulsion the preliminary laboratory tests will have given some indication of the probable strength of the fungicide required for the field test, say 10 per cent. Four plots of 25 trees are then treated with a different concentration around this figure say 5, 7.5, 10 and 15 per cent. in water. Treatment by spraying each tapping day is given and a close watch is kept for the appearance of symptoms of bark burning or too deep penetration of the fluid, together with a daily record of the number of trees showing mould. Within two weeks it can usually be discovered that the lowest strength is useless for killing the fungus while possibly the highest strength, though killing the fungus within the

FUNGICIDE TESTS - SETAPAK.
NOV. - DEC. 1934.



first few days, also shows signs of over-penetration and consequent bark burning. Thus the early field tests give the probable minimum strength required to kill the fungus and the maximum safe strength at which the fungicide can be applied to the bark without injury.

The plot receiving only a 5 per cent. strength of fungicide will then be treated with a 7.5 per cent. solution and the "15 per cent." plot will be treated with a 12.5 per cent. solution, while a further main plot of 100 trees will be treated as in estate practice with an average strength of fungicide, say in this case a 10 per cent. concentration, for one month, records being taken each day of the number of trees and condition of the renewing bark before, during and after the experiment.

During these tests no special effort is made to prevent infection from neighbouring, untreated trees, and each tapper may tap a number of treated and untreated trees at will so that the test is as thorough as possible.

When treatment is stopped, a note is usually made of the time required for the reappearance of mould on the treated trees.

Any preparation which fails to control the disease during a period of one month's treatment is considered as unsuitable for a place on the White List of fungicides for control of the disease.

On the other hand, fungicides which cause bark burning at or near the strength required for killing the mould are also regarded as unsuitable. In fact this has been the chief reason for rejection of many proprietary products.

As a point of interest, a record, published in the Annual Report of the Rubber Research Institute, 1934, p. 94, of an experiment to demonstrate the efficiency of the various types of fungicides used for the control of the disease in heavily-infected small-holdings rubber areas is given below. The materials used were Killgerm (a proprietary fungicide) and Linsocresyl (prepared in the Pathological Division), as representatives of the tar-acid emulsions; Cargilineum 'B' mixture and Agrisol Paste (both proprietary fungicides), as representatives of the greasy water-proof pastes; Singapore Tar and Asphalt-Solar Oil plus 10 per cent. Brunolinum, as representatives of the black water-proof paints which find a fairly wide use. A resin-spirit mixture in common use in the Netherlands Indies was also included but, during the wet weather was found seriously to damage the bark, although on the advent of dry weather early in December further application proved to have no ill-effects on the renewed bark. The results are given in tabular and graphical form. The initial degree of infection in each plot was 100 per cent. The condition of the renewed bark was noted weekly and the flow of latex was judged by pricking the renewing bark with a knife point. It has frequently been noticed that, if the fungicide has damaged the bark, even only slightly, the latex flow is poor and the latex produced is of a thin watery nature. The results indicate the superiority of the tar-acid emulsions.

Fungicide Tests, 1934.

	Fungicide	Application	When clear of Disease	Condition of Bark	Latex
1.	Killgerm 10 per cent. in water	Daily	After 16 paintings	Very good condition	Good
2.	Linsocresyl 10 per cent. in water	Daily	After 17 paintings	Good condition	Good
3.	Cargilineum applied neat	Every 4th day	After 6 paintings	Fair to good	Good
4.	Resin Spirit applied neat	Every 3rd day	After 6 paintings	Hard crust formed. Bark damaged in wet weather. Renewal of bark good in dry weather.	Fair to good
5.	Singapore Tar applied neat	Every 4th day	After 7 paintings	Burning where the bark is tapped deeply, otherwise good bark renewal.	Fair
6.	Asphalt-Solar Oil applied neat	Every 3rd day	After 7 paintings	-do-	Fair to good
7.	Agrisol Paste applied neat	Every 4th day	After 6 paintings.	-do-	Fair.

Guarantee.

A proprietor whose preparation gives satisfactory results in the above tests is required to give a guarantee that the composition and formula of the preparation will remain constant, and, should any alterations take place, he is required to notify the Director of Agriculture at once so that, if necessary, further tests can be made. If these conditions are complied with the preparation is gazetted by Government and placed on the official list of fungicides recommended for use in control of the disease.

Nomenclature.

In conclusion, a few words on the terminology used in this article may serve to clear up misunderstandings. In *Webster's International Dictionary* the following definitions of the words Fungicide, Antiseptic and Disinfectant may be found.

"Fungicide. (n)—Any substance which destroys fungi."

"Antiseptic. (n)—An antiseptic substance. That which may be used to destroy bacteria with little or no harmful effect on the living body."

"Disinfectant. (n)—A substance adopted for destroying the bacteria in, and rendering harmless and inoffensive, objects, places or materials containing putrefactive or pathogenic bacteria. A disinfectant differs from an antiseptic in not being intended for use upon the living body; hence many substances not applicable as antiseptics may serve as disinfectants or stronger solutions of antiseptic substances may be employed."

If, in the above definitions "rubber tree" is substituted for "the living body," the correct use of the above terms in plant therapeutics can better be understood.

In general, a substance used in low concentrations may be used as a fungicide, while the same substance in higher concentration becomes a disinfectant and plant destroyer. The margin between these two strengths may be regarded as the margin of safety and the greater this margin the safer the material is for use as a fungicide. This is of importance when it is remembered that, in wet weather, it is more difficult to control Mouldy Rot and there is a great tendency to use stronger fungicides; if there is only a small safety margin this is impossible without having considerable trouble from bark burning.

In the White List of fungicides given previously the normal strength for use of the fluid and the maximum strength which it is reasonably safe to use under abnormal conditions, *i.e.* during wet weather, are given.

Summary.

A brief history is given showing the points which led to the official testing of all substances used for the control of Mouldy Rot and the provision of an official list of fungicides for use for such purpose in Malaya.

A description is given of laboratory and field tests formulated for the purpose of testing these substances.

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VARIETAL AND MANURIAL TRIALS WITH DERRIS

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Introductory.

Attention was drawn in a previous paper (1) to the wide differences found in the amount of ether extract of *Derris elliptica* when cultivated at the Experimental Plantation, Kuala Lumpur, and at the Central Experiment Station, Serdang.

Results of analysis showed that while marketable roots of this species of Derris cultivated at Kuala Lumpur yielded an ether extract amounting to approximately 25 per cent. on a moisture-free basis, roots from plants of the same species and of the same age from Serdang yielded an ether extract of only about 10 per cent.

A suggestion was made that the difference might be accounted for by the lack of some particular nutrient, poor soil conditions, or unsuitable environment.

Experiments were therefore carried out to determine the variations in the amounts of the important plant nutrients for this species when cultivated both at Kuala Lumpur and at Serdang. Further, in view of the possibility of other species being similarly affected, the investigation was extended subsequently to include all the principal species of Derris established at both Stations.

Manurial trials have also been carried out with different species at Serdang to ascertain the extent to which the yield of root and its toxicity might be influenced as a result of the application of artificial fertilizers.

Exchanges of planting material between various Stations have also been effected to determine the extent of the variation in toxicity due to change of environment.

(A). REMOVAL OF PLANT NUTRIENTS.

The following species were included in the investigation:—

Species of Derris.		Location.
D. elliptica		Kuala Lumpur.
do.		Serdang.
D. elliptica, Sarawak creeping		Kuala Lumpur.
do.	do.	Serdang.
D. malaccensis var. *sarawakensis*		Kuala Lumpur.
do.	do.	Serdang.
D. malaccensis, tuba merah		Kuala Lumpur.

Collection and Analysis of Samples.

Sufficient plants were selected at random to yield not less than 20 lbs. of material. In the case of *D. elliptica*, Sarawak creeping, which yielded approximately 6 lbs. of material per plant, six plants only were selected.

The plants varied in age from 24 to 26 months, so that it may be assumed they had reached maturity.

The plants were removed complete with roots and the latter washed to remove adhering soil. Care was taken not to damage the cortex of the root during this operation.

Owing to the impossibility of direct sampling, the plants were separated into component parts before analysis, the proportions of these being also determined in order to allow the composition of the plants to be calculated.

The component parts selected were leaves, stems, and roots.

As regards the analysis of the components, determinations were made of moisture, carbon, nitrogen, phosphoric acid, potassium, calcium, and magnesium.

Owing to the large number of separate estimations involved, where possible, volumetric methods were substituted for the more laborious gravimetric processes.

Interpretation of Results of Analysis.

The results of analysis of the various components and the calculated composition of the plants are given in Table I. In order to make the table as concise as possible, only the average, maximum, and minimum figures are given.

The figures show no specific differences in the amounts of the principal plant nutrients in the various species. Variation is general, the widest differences occurring in the potassium and calcium contents. In this connexion it is interesting to note that in those cases in which the calcium content is low the potassium content is high and *vice-versa*. This distribution of potassium and calcium is not, however, a characteristic of the species; for example, in the case of *D. malaccensis* var. *sarawakensis* cultivated at Kuala Lumpur and Serdang the following results for the whole plant were obtained:—

Location		Potassium as K_2O per cent.	Calcium as CaO per cent.
Kuala Lumpur	...	0.20	0.48
Serdang	...	0.61	0.17

While it is realized that chemical analysis of a plant cannot be relied upon as an accurate guide to its requirements, either from the point of view of growth or of the development of some special characteristic, the results are of value as regards forming an estimate of the approximate amounts of plant nutrients removed when the crop is harvested.

These figures will vary both for the particular species and with the planting distance, while they are also dependent upon whether the stems of the plants are removed for propagating purposes or are returned to the land.

Table I.

Analysis of Component Parts and Calculated Composition of Plants.

(Results expressed in parts per cent.)

Details	Nutrient	Average	Maximum	Minimum
Leaf	Carbon ...	15.17	22.12	11.50
Proportion of leaf 19.8 per cent.	Nitrogen ...	0.97	1.38	0.76
	Phosphoric acid as P_2O_5	0.17	0.22	0.14
Average moisture content 64.0 per cent.	Potassium as K_2O ...	0.58	0.86	0.30
	Calcium as CaO ...	0.44	0.60	0.24
	Magnesium as MgO ...	0.08	0.10	0.05
Stem	Carbon ...	13.28	16.14	10.45
Proportion of stem 61.8 per cent.	Nitrogen ...	0.56	0.63	0.47
	Phosphoric acid as P_2O_5	0.15	0.18	0.12
Average moisture content 61.3 per cent.	Potassium as K_2O ...	0.40	0.60	0.16
	Calcium as CaO ...	0.36	0.51	0.15
	Magnesium as MgO ...	0.05	0.07	0.01
Root	Carbon ...	17.34	22.36	14.60
Proportion of root 18.4 per cent.	Nitrogen ...	0.53	0.70	0.41
	Phosphoric acid as P_2O_5	0.13	0.18	0.10
Average moisture content 55.3 per cent.	Potassium as K_2O ...	0.36	0.57	0.14
	Calcium as CaO ...	0.26	0.40	0.12
	Magnesium as MgO ...	0.04	0.06	0.03
Plant (calculated)	Carbon ...	14.40	18.47	11.42
Average moisture content 60.7 per cent.	Nitrogen ...	0.64	0.79	0.51
	Phosphoric acid as P_2O_5	0.15	0.18	0.12
	Potassium as K_2O ...	0.43	0.65	0.18
	Calcium as CaO ...	0.36	0.51	0.16
	Magnesium as MgO ...	0.05	0.07	0.02

Table II.

Limits of Amounts of Plant Nutrients removed per Acre per Crop.

(5,590 plants per acre)

Species of Derris	Nutrient	Average lbs.	Maximum lbs.	Minimum lbs.
D. elliptica	Carbon ...	1851.4	2374.7	1468.3
	Nitrogen ...	82.3	101.6	65.6
	Phosphoric acid as P_2O_5	19.3	23.1	15.4
	Potassium as K_2O ...	55.3	83.6	23.1
	Calcium as CaO ...	46.3	65.6	20.6
	Magnesium as MgO ...	6.4	9.0	2.6
D. elliptica, Sarawak creeping	Carbon ...	5151.7	6607.9	4085.7
	Nitrogen ...	229.0	282.6	182.5
	Phosphoric acid as P_2O_5	53.7	64.4	42.9
	Potassium as K_2O ...	153.8	232.5	64.4
	Calcium as CaO ...	128.8	182.5	57.2
	Magnesium as MgO ...	17.9	25.0	7.2
D. malaccensis var. *sarawakensis*	Carbon ...	2736.8	3510.4	2170.5
	Nitrogen ...	121.6	150.2	96.9
	Phosphoric acid as P_2O_5	28.5	34.2	22.8
	Potassium as K_2O ...	81.7	123.5	34.2
	Calcium as CaO ...	68.4	96.9	30.4
	Magnesium as MgO ...	9.5	13.3	3.8
D. malaccensis, tuba merah	Carbon ...	1609.9	2065.0	1276.8
	Nitrogen ...	71.6	88.3	57.0
	Phosphoric acid as P_2O_5	16.8	20.1	13.4
	Potassium as K_2O ...	48.1	72.7	20.1
	Calcium as CaO ...	40.3	57.0	17.9
	Magnesium as MgO ...	5.6	7.8	2.3

While, therefore, no definite figures can be given, an estimate of the total amount of plant nutrients involved for each of the four species is given in Table II. These figures are based on the results of analysis in Table I, together with the following additional data:—

Planting distance	3 ft. x 3 ft. (triangular)
No. of plants per acre	5590
Average weight of plants:	
D. elliptica	2.3 lbs.
D. elliptica, Sarawak creeping	6.4 ,,
D. malaccensis var. *sarawakensis*	3.4 ,,
D. malaccensis, tuba merah	2.0 ,,

The figures in Table II show that considerable amounts of plant nutrients, particularly in the case of *D. elliptica*, Sarawak creeping, are likely to be removed in the course of cultivation and point therefore to the necessity for manuring, if the land is kept continuously under cultivation with this crop.

(B). MANURIAL EXPERIMENT.

As far as can be ascertained no systematic manurial trials have been undertaken previously with this crop when cultivated under estate conditions. An exploratory investigation was therefore carried out in which for convenience the sub-plots were arranged systematically and not randomized.

The objects of the experiment were to ascertain the effects of the addition of artificial fertilizers on (*a*) yields of roots of different species, (*b*) ether extracts and rotenone contents of these roots with varying age, and (*c*) to indicate profitable lines of future and more exact work.

Lay-Out of Experimental Plots.

Care was taken to select land which had been cultivated previously with another crop, thereby ensuring that the effect of the manurial treatment would not be masked by a high natural fertility factor.

The soil belonged to the Hill Quartzite type and may be described as a yellow to dark sandy loam in which the fine fractions vary from 40 to 50 per cent.

As regards previous cultivation, the area selected formed part of a block planted originally with candlenut, *Aleurites moluccana*. This crop was, however, subject to attacks of die-back and termites, necessitating its removal.

Five species of Derris were selected for the experiment as follows:—

(*a*) *Derris polyantha*?*
(*b*) *Derris elliptica* (Singapore type).
(*c*) *Derris elliptica*, Sarawak creeping.
(*d*) *Derris elliptica* (Serdang type).
(*e*) *Derris malaccensis* var. *sarawakensis*.

As regards *D. elliptica*, there was insufficient planting material of the Kuala Lumpur type available; a supply of cuttings of this species was therefore

* The botanical identification of this species must be regarded as doubtful.

obtained from Changi, Singapore. Reference to the paper previously mentioned (1) will show that roots of this species from Singapore compared favourably as regards both ether extract and rotenone content with those from Kuala Lumpur.

These five species were planted in November 1932 in an acre plot divided into 15 sub-plots, which allowed of each species being replicated three times.

Plants were established from stem cuttings and were spaced 3 ft. x 3 ft. triangularly, equivalent to 5,590 plants per acre.

The ultimate arrangement of the sub-plots is shown in Diagram I.

Diagram I.

Arrangement of Sub-plots in Manurial Experiment with Derris.

← 5 chains →

↕ 2 chains

a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
					Unmanured									
a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
				Manured twice										
a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
				Manured and limed										

Notes: 1. Sub-plots marked with letters were planted as follows:
(a) *Derris polyantha?*
(b) *Derris elliptica* (Singapore type).
(c) *Derris elliptica*, Sarawak creeping.
(d) *Derris elliptica* (Serdang type).
(e) *Derris malaccensis* var. *sarawakensis.*
2. The area of each unmanured sub-plot amounts to 1/30th acre; the area of each sub-plot, either manured twice or manured and limed, is 1/60th acre.

Manurial Treatment.

One month after planting, the manurial dressing, consisting of the following fertilizers, was supplied:—

Details of Manure.		Rate of Application lbs. per acre.
Calcium cyanamide	...	280 (53 lbs. N).
Basic slag	...	336 (54 lbs. P_2O_5).
Sulphate of potash	...	84 (40 lbs. K_2O).

Table III.

Average Number of Plants Harvested per Sub-plot with Average Weight of Air-dry Marketable Roots per Plant.

Species of Derris	Control Area of sub-plot 1/30th acre No. of plants per sub-plot 186.		Manured Twice Area of sub-plot 1/60th acre No. of plants per sub-plot 93.		Manured and Limed Area of sub-plot 1/60th acre No. of plants per sub-plot 93.	
	No. of plants harvested	Weight of air-dry marketable roots per plant.	No. of plants harvested	Weight of air-dry marketable roots per plant.	No. of plants harvested	Weight of air-dry marketable roots per plant
		ozs.		ozs.		ozs.
Derris polyantha?	55	0.67	25	2.03	27	2.56
Derris elliptica (Singapore type)	27	0.21	10	0.27	10	0.27
Derris elliptica, Sarawak creeping	68	3.87	38	2.83	36	4.85
Derris elliptica (Serdang type)	110	1.23	55	2.14	57	2.16
Derris malaccensis var. *sarawakensis* ...	138	0.62	74	1.54	77	1.28

Note:—In order to obtain the average number of plants per sub-plot that would have been harvested, assuming that no plants had been reserved for chemical analysis, the individual figures should be increased by 7, this being the nearest integer to 6 2/3, 20 plants in all having been reserved from the three replications of each treatment.

The soil was forked lightly when the manures were applied. After manuring, the sub-plots received no further treatment beyond periodic weeding.

Difficulty was experienced in establishing the cuttings and subsequent growth was poor, the appearance of the manured and of the control sub-plots showing no apparent difference after one year's growth. Accordingly, in October 1933, the manured sub-plots were sub-divided, one half receiving a second dressing of artificials at the same rate as that previously applied, the other a dressing of slaked lime at the rate of 6 cwts. per acre.

After a further two months both series of the double-treated sub-plots had improved considerably in appearance, although in no case was there vigorous growth.

Twenty-four months after planting in the field, samples, consisting of all the roots from 10 plants selected at random from the above replications of each species and treatment, making 15 samples in all, were taken for analysis. The results of analysis will be discussed later.

The main crop was harvested when the plants were approximately 26 months old, except for 10 plants of each species which were left for a further four months to provide roots for analysis from plants 30 months old.

Yield of Root.

The figures for the yields of root from the different species with varying manurial treatments are given in Tables III and IV.

Table IV.

Average Weights of Air-dry Marketable Root Harvested per Sub-plot (1/60th acre).

Species of Derris	Control	Manured Twice	Manured and Limed.	Variety Means
	lbs.	lbs.	lbs.	lbs.
Derris polyantha ? ...	1.16	3.34	4.33	2.94
Derris elliptica (Singapore type) ...	0.18	0.16	0.18	0.17
Derris elliptica, Sarawak creeping	8.05	6.72	10.89	8.55
Derris elliptica (Serdang type) ...	4.21	7.35	7.72	6.43
Derris malaccensis var. *sarawakensis* ...	2.70	7.08	6.15	5.31
				General Mean
Manurial Means ...	3.26	4.93	5.85	4.68

Note:—The average weights of root per sub-plot that would have been harvested, assuming that no plants had been reserved for chemical analysis, can be calculated from the results given in Table III.

Only the weights of the marketable or "fine" roots—that is, roots of a diameter half-an-inch or less—have been included; "coarse" roots—those greater than half-an-inch in diameter—being neglected.

To make the tables as concise as possible, only the average weights of air-dry "fine" roots per plant and per sub-plot for the three replications are given.

As regards the amount of marketable root per plant the results in Table III indicate that the highest yield is obtained with *Derris elliptica*, Sarawak creeping, the lowest with *D. elliptica* (Singapore type). It is possible that the latter species is unsuited to the comparatively heavy soil on which the experiment was carried out.

In the case of Table IV, the figures for the weights of roots for the control sub-plots have been halved in order to make them directly comparable with those for the sub-plots receiving manurial treatment.

Although, strictly speaking, statistical methods are inapplicable owing to the systematic arrangement of the sub-plots, the results in Table IV have been statistically examined for the purpose of a preliminary exploration, and show that there is no significant interaction between species of Derris and manures.

The following are the calculated significant differences in terms both of the general mean and of percentage of the general mean for (*a*) varieties (*b*) manurial treatment and (*c*) manures and control.

(*a*) 2.28 lbs. or 48.7 per cent.
(*b*) 1.74 lbs. or 38.2 per cent.
(*c*) 1.37 lbs. or 29.3 per cent.

From a consideration of these figures it appears that *Derris elliptica*, Sarawak creeping, *D. elliptica* (Serdang type) and *D. malaccensis* var. *sarawakensis* are significantly better than *D. polyantha*? and *D. elliptica* (Singapore type), while *D. elliptica*, Sarawak creeping, is significant over *D. malaccensis* var. *sarawakensis*.

The yields from the manured and limed sub-plots are significantly better than those from the controls.

Effect of Manurial Treatment on Toxicity.

The roots from the plants selected for analysis were washed free from adhering soil, dried and separated into "coarse" and "fine" roots.

In all cases analysis was restricted to the "fine" or marketable roots.

The methods used for the determination of ether extract and rotenone were those described in (2).

The results of analysis of roots from the different species with varying manurial treatments and at different ages are shown in Table V. To make the table as concise as possible only the figures, calculated on a moisture-free basis, are given.

The figures for roots from plants 24 months old are irregular and indicate no definite relationship between toxicity and manurial treatment. Apart from *Derris*

Table V.
Results of Analysis of Roots of Varying Age with Different Manurial Treatment.

(Moisture free basis)

Details of Sample	24 months old		30 months old	
	Ether Extract	Rotenone	Ether Extract	Rotenone
	per cent.	per cent.	per cent.	per cent.
Derris polyantha ? ...				
Control ...	10.65	2.90		
Manured twice ...	9.99	2.74	11.89	2.70
Manured and limed ...	10.73	2.72		
Derris elliptica (Singapore type)				
Control ...	20.76	6.56		
Manured twice ...	20.36	6.85	23.15	8.91
Manured and limed ...	22.09	6.71		
Derris elliptica, Sarawak creeping				
Control ...	17.97	3.92		
Manured twice ...	20.42	5.35	22.43	6.03
Manured and limed ...	18.70	5.28		
Derris elliptica (Serdang type)				
Control ...	10.05	2.29	6.88	0.99
Manured twice ...	4.78	1.14	9.73	1.78
Manured and limed ...	5.07	0.87	10.11	1.90
Derris malaccensis var. *sarawakensis*				
Control ...	19.72	2.45	20.16	3.22
Manured twice ...	18.85	2.37	23.67	2.94
Manured and limed ...	16.41	1.95	23.87	2.56

elliptica (Serdang type), the relatively small variations in ether extract are only of the order expected when dealing with roots from a mixed stock of cuttings.

While the variations between the three samples of roots of *D. elliptica* (Serdang type) would at first sight appear to be inexplicable, recent work carried out on the variation between the toxicities of roots from individual plants of this species has shown that such differences may be expected, bearing in mind also that the samples of root were drawn from a relatively small number of individual plants.

Similarly for roots from manured plants 30 months old, although the results indicate in every case a definite increase in toxicity compared with roots from plants 24 months old, it is doubtful whether the increase is real or apparent. In the former case the increase could be attributed to the natural development of the plants, in the latter case to a fortuitous selection of plants for analysis.

Details regarding the range of variation in toxicity between the root systems of individual plants from the various species under discussion will be given in a paper shortly to be published on this subject.

General Considerations on Yield and Toxicity.

Combining the results for yields of root and toxicity the figures indicate clearly the possibilities of *Derris elliptica*, Sarawak creeping, as a species likely to be successful under estate conditions and to meet the present market requirements in respect of both ether extract or rotenone. The present standards may be taken as 18 per cent. ether extract, rotenone 4 or 5 per cent., calculated on the roots as delivered. A higher price is paid for roots sold on a rotenone basis than on an ether extract basis.

Apart from the question of yields under the conditions of the present experiment, the figures also show that *D. elliptica* (Singapore type) has the highest combined toxicity, while *D. malaccensis* var. *sarawakensis* has possibilities as regards complying with the market requirements for a root sold on a basis of ether extract.

Neither *D. elliptica* (Serdang type) nor *D. polyantha*? can meet the market requirements in respect of toxicity and therefore the cultivation of these species can be neglected.

(C). VARIATION IN TOXICITY WITH CHANGE OF ENVIRONMENT.

The variations found in toxicity between different types of the same species of Derris, for example, *D. elliptica* (Singapore type) and *D. elliptica* (Serdang type), have raised the question of the chances of the roots of a particular species remaining constant in composition when cultivated under varying conditions.

As indicated previously such an investigation is preferably carried out with planting material derived from the same parent plant in order to eliminate the variations existing between roots from individual plants. As far as the writers are aware no records of work on these lines have been published.

As a result, however, of transfers of planting material a certain amount of information has gradually accumulated regarding the toxic contents of roots from plants of differents species when grown in various parts of Malaya.

A stock of cuttings of *Derris elliptica* (Singapore type) was received from an estate near the boundary of Negri Sembilan and Johore, the original planting material having been obtained from Changi, Singapore.

The soil at Changi is very sandy; that on the estate in question may be described as a clay loam.

A sample of root from this same stock was analysed with the following results, the plants being approximately 29 months old.

	Moisture-free basis per cent.
Rotenone	8.13
Ether extract	29.12

Cuttings from the plants were established in Kuala Lumpur on a soil of the Hill Quartzite type and which may be described as a sandy clay loam.

Roots from the plants were analysed when 25 months old and 32 months old respectively. The results of analysis are shown below, the figures in both cases being calculated on a moisture-free basis.

Age of Plants	Rotenone per cent.	Ether Extract per cent.
25 months	6.99	19.73
32 months	6.50	23.47

Allowing, therefore, for the mixed stock of planting material and variations in age, it is claimed that there are grounds for assuming that toxicity of root is not affected to a marked extent as a result of change of environment.

Additional evidence in support of this claim is found in the results of analysis of this type of *D. elliptica* quoted earlier in this paper in connexion with the manurial experiments. In that case the cuttings were despatched direct to Serdang from Singapore. Soil conditions were again different in both places.

Further, the results of analysis of roots from plants 24 months old grown in Brunei on a heavy clay soil from cuttings obtained from Changi have shown the high quality of the root to be maintained as the following figures show:—

	Moisture-free basis per cent.
Rotenone	8.33
Ether extract	26.33

D. elliptica (Serdang type) has been grown both at Serdang and at Kuala Lumpur. The soil at Serdang belongs to the Valley Quartzite type and may be described as a yellow to grey loam; that at Kuala Lumpur belongs to the Hill Quartzite type and may be described as a sandy clay loam.

The results of analysis were as follows; in all cases the figures have been calculated on a moisture-free basis.

Location and Age		Rotenone per cent.	Ether Extract per cent.
Kuala Lumpur, 25 months	...	1.85	9.40
Serdang, 26 months	...	3.10	12.72
Kuala Lumpur, 32 months	...	1.88	8.69
Serdang, 33 months	...	1.03	6.55

A poor quality of root appears to be an inherent characteristic of this type of *D. elliptica* irrespective of a change of environment.

D. polyantha? has also been grown alongside *D. elliptica* (Serdang type) both at Serdang and at Kuala Lumpur with the following results: in both cases the figures have been calculated on a moisture-free basis:—

Location and Age		Rotenone per cent.	Ether Extract per cent.
Kuala Lumpur, 25 months	...	2.97	9.70
Serdang, 24 months	...	2.90	10.65

While, therefore, it seems reasonable to assume that toxicity is not affected to any marked extent as a result of change of environment, the variations in toxicity between individual plants necessitate the greatest care being taken in the selection of material for planting purposes. Cuttings should be taken from a wide range of plants, while it would also be an advantage to know the toxicity of the roots of the stock in question as a result of the analysis of an average sample.

Summary of Experimental Work.

As a result of the various experiments the following observations are offered:—

1. Results of analysis indicate no specific differences in the amounts of the principal plant nutrients in the various species of Derris examined.

2. Calculations show that considerable amounts of plant nutrients are likely to be removed in the course of cultivation of Derris and point to the necessity for manuring the land.

3. An exploratory manurial experiment with five different species of Derris is described. The main objects of the experiment were to ascertain the effects of the addition of artificial fertilizers on (*a*) yields of roots of different species, and (*b*) amounts of ether extract and rotenone in roots of varying ages.

4. The figures for the yields of roots were statistically examined and show no significant interaction between species of Derris and manures.

5. The yields from the manured and limed sub-plots were significantly better than those from the controls.

6. The results of analysis of the roots are irregular and indicate no definite relationship between toxic content and manurial treatment. It is uncertain to

what extent the figures were influenced by the variations known to exist between the toxic contents of roots from individual plants.

7. Combining the results for yields of root and toxic content the figures indicate the possibility of *Derris elliptica,* Sarawak creeping, as a species suitable for estate cultivation.

8. An account of transfers of planting material of different species between different parts of Malaya is given together with the corresponding results of analysis for roots at different ages. As a result it seems reasonable to assume that toxicity is not affected to any marked extent as a result of change of environment.

Acknowledgment

The writers wish to acknowledge the assistance rendered by Mr. J. H. Dennett, Soils Chemist, in the statistical examination of the figures for the yields in the manurial experiment.

References.

(1) Georgi, C. D. V. and Gunn Lay Teik. The Rotenone Content of Malayan Tuba Root. *Malayan Agricultural Journal,* Vol. XX, No. 10, October 1932, page 498.

(2) Georgi, C. D. V. and Gunn Lay Teik. The Valuation of Tuba Root. Special Bulletin, Scientific Series No. 12, 1933.

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THE EFFECT OF IRRIGATION OF PADI WITH SALT WATER

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In view of the large number of new padi areas being opened up or being considered for opening up and their frequent proximity to the sea, with the possibility of contamination of irrigation water with sea water, at least in the early stages, it was considered advisable to make some exploratory trials, in pots, of irrigating a local variety of padi with salt water of different strengths, to obtain some idea of the amount of salt which padi can withstand.

For this purpose a Nachin variety of padi (F.S. 27) was planted two plants per pot on soils derived from the following areas:—Malacca, Kamunting (reslimed mining land), Titi Serong, Selinsing, Lenggong (high-yielding area), Kuala Pilah (typical granite padi land), Penang, Raub (normal), Raub (high-yielding).

Each of these soils was irrigated with water containing 20.0, 2.0 and 0.2 per cent. of sodium chloride.

(*a*) *Sodium Chloride (20.0 per cent.).*

Only in the case of the richest soil (Penang) was padi able to survive until harvest and even then the amount of grain was negligible. Growth was fairly good for the first month followed by rapid deterioration. By the end of the third month all plants had died except those planted on Raub (high-yielding), Penang and Titi Serong soils. By the end of the fourth month only padi on Penang soil survived.

(*b*) *Sodium Chloride (2.0 per cent.).*

Up to the end of the second month growth was generally good with the exception of the plants on Kuala Pilah soil (the poorest soil used), but during the third month all were sickly except those on Penang and Lenggong soils; by the beginning of the fourth month the padi on Titi Serong soil was dying. All yielded grain except those grown on Malacca and Titi Serong soils.

(*c*) *Sodium Chloride (0.2 per cent.).*

It would appear that this concentration of salt had little or no effect on general growth. All yielded grain except when planted in Raub (normal) soil and in view of the fact that this soil gave a yield with the 2.0 per cent. salt it must be concluded that the lack of yield was due to other causes.

In weight there was not a great deal of difference between the 2.0 and the 0.2 per cent. series of experiments. The mean yield was slightly higher for the former concentration.

General appearance of the plants in the 2.0 per cent. series was, however, not so good as in the 0.2 per cent. series and, as a general inference, it would

seem that padi is not likely to withstand much over 2.0 per cent. concentration of salt for a lengthy period. The soils used were quite fresh and therefore were probably not greatly affected by the brackishness at first, but a second season would probably intensify growth differences and subsequently affect yields.

Unfortunately owing to the writer being on long leave it was not possible to undertake a subsequent examination of the soil for amount of chlorides absorbed.

The figure of 20 per cent. is of the same order as the Dead Sea. The percentage of salt in ocean water is between 3.5 and 5.0 per cent.

Received for publication 15th April 1936.

Abstract.

TWENTY-FIFTH REPORT ON NATIVE RUBBER CULTIVATION IN THE NETHERLANDS INDIES.

*Fourth Quarter 1935, with additional data up to the end of February 1936.**

Prices.

The fourth quarter of 1935 opened with a quotation for Java standard sheet in Batavia of 18 guilder-cents per half kilogram. A steady improvement then set in till, on October 26th, a price of 20 cents was reached. The advance was the result of several causes, amongst which may be mentioned the reduction in stocks held in England and Malaya and the satisfactory consumption figures of the United States of America. Moreover, the market was favourably influenced by the action of the Netherlands Indian Government in taking up approximately 20,000 tons of licenses previously issued to estates, in an effort to compensate for the exports of native-grown rubber in excess of the quota that had been assigned to it. Finally it became apparent from the rapidly successive increases in the extraordinary export duty levied on the native-grown product that everything possible was being done to make the restriction in that direction as effective as possible.

The price level of 20 guilder-cents per half kilogram was maintained throughout the quarter, except for a brief reaction on December 4th, following the announcement of the decision of the International Rubber Committee to raise the basic quota of the Netherlands Indies for the years 1936, 1937 and 1938 by 57,000 tons, 53,000 tons and 55,000 tons respectively, and of the retention of the restriction percentage for the first half of 1936 at 40 per cent. It was soon realized, however, that the quota revision for the Netherlands Indies meant in actual fact a strengthening of the restriction system and in December 7th the price again reached 20 cents.

The half-monthly averages of the daily quotations for Java standard sheet in Batavia for the fourth quarter were 18.3, 19.6, 20.1, 19.8, 19.6 and 19.9 guilder-cents per half kilogram. The half-monthly averages in January 1936 were 19.8 and 21.0; and for February 21.8 and 22.5.

The extraordinary export duty on native-grown rubber was raised from 14½ cents to 16 cents per half kilogram on February 12th, and on February 20th to 16½ cents. These increases were made to compensate for the price advance which stimulated production.

In the second half of October, medium blanket was quoted at an average of 6 per cent. lower than standard sheet, but in the second half of December this margin fell to 3½ per cent., and since about the middle of January it has not been more than about 1½ per cent.

Production and Exports.

The following table shews the monthly production and exports of native-grown rubber during 1935.

* Abstract from *The Netherlands Indies*, Vol. IV, No. 8. April 16th, 1936.

Table 1.

Production and Exports of Native-Grown Rubber in 1935.
(In Metric Tons)

Month 1935	Total Exports	Changes in Stocks Held	"Corrected" Production
January ...	9,865	− 3,378	6,487
February ...	17,179	− 5,260	11,919
March ...	9,042	+ 1,536	10,578
April ...	13,809	− 675	13,134
May ...	22,628	− 3,481	19,147
June ...	14,576	− 1,470	13,106
July ...	8,227	+ 1,290	9,517
August ...	9,870	+ 1,255	11,125
September ...	9,763	+ 947	10,710
October ...	17,806	− 3,400	14,406
November ...	9,260	+ 37	9,297
December ...	2,866	+ 1,746	4,612
TOTAL ...	144,891		134,038

In Table 2 are given the actual and the allotted exports of native-grown rubber in the first two restriction years.

Through the buying back of 19,667 tons of licences that had been issued to estates, the excess for 1934/35 was reduced to 19,038 tons.

Types of Rubber Exported.

The share taken by dry rubber in the total exports of native-grown rubber is constantly increasing. In the first half of 1934, only 15½ per cent. of the exports of this class of rubber were shipped as dry rubber; the percentage rose, however, to 85.4 in the quarter under review.

The exports from the Western Division of Borneo, Tapanuli, Banka, and the Rhio Free Area consisted in the last half of 1935 almost entirely of dry rubber. Wet rubber exports from ports in Sumatra West Coast and Acheen were insignificant, but Palembang, Bangkalis, the Southern and Eastern Division of Borneo, and Rhio Indragiri were still exporting quite large quantities of wet rubber

as the following figures shew:—Palembang 5,148 tons, Bengkalis 2,922 tons, S. and E. Borneo 1,926, and Rhio Indragiri 1,254 tons, exported wet.

The trend of quarterly exports of native rubber is given in Table 3.

Table 2.

Exports of Native-Grown Rubber in the First and Second Years of Restriction.

(In Metric Tons)

	June to December 1934	January to December 1935
Balance from previous year	—	8,450
Shipments during period in question	83,985	144,592
Placed under customs control at end of period ...	258	30
Exports to be charged against restriction quota ...	84,243	153,072
Quota allotted	75,793	114,367
Amount by which quota was exceeded	8,450	38,705

Table 3.

Quarterly Exports of Native-Grown Rubber.

(In Metric Tons, Dry Equivalent)

Quarter		Group 1a Blankets	Group 1b Dry native Sheets	Group 11a Scrap	Group 11b Wet Cake	Percentage of the total shewn by	
						1a + 1b	11a + 11b
1934	1st	7,878		1,090	41,740	15.5	84.5
	2nd	13,823		1,972	51,619	20.5	79.5
	3rd	17,198		1,658	21,537	39.7	60.3
	4th	4,577	5,138	123	12,808	42.3	57.7
1935	1st	8,299	7,924	953	18,863	45.2	54.8
	2nd	13,851	15,508	1,009	20,646	57.7	42.3
	3rd	10,230	9,514	19	8,097	70.9	29.1
	4th	13.104	12,452	16	4,361	85.4	14.6

Individual Restriction Scheme.

The registration of rubber plantations preparatory to the general introduction of a system of individual restriction is progressing in a satisfactory manner. In the quarter under review the preliminary experimental registrations (comprising two Sub-divisions of each of the Departments of Palembang, South and East Borneo, West Borneo and Sumatra's East Coast) were completed and the general registration of all plantations was begun. The data of the registration at present available do not permit even a rough estimate of the results that may be expected. The complete data of the registration and the test tappings made coincidentally will only be available in the course of the second half of this year. The progress of the work justifies the expectation that the individual restriction scheme could be applied to the whole of the Netherlands Indies as from January 1st, 1937.

Review.

Cultivated Crop Plants of the British Empire and the Anglo-Egyptian Sudan (Tropical and Sub-Tropical).

H. C. Sampson, C.I.E., B.SC., F.L.S., *251 pages. Royal Botanic Gardens, Kew. Bulletin of Miscellaneous Information: Additional Series XII. London, H.M. Stationery Office, 1936. Price 6 shillings 6 pence.*

This bulletin is referred to in the introduction as an Inventory of Cultivated Crop Plants grown in all tropical and sub-tropical countries of the British Empire and Anglo-Egyptian Sudan. Its publication was proposed at the Conference of Colonial Directors of Agriculture held in 1931, and is based on the replies to a questionnaire issued by the Director of the Royal Botanic Gardens, Kew. Upon receipt of answers to the questionnaire from the various Departments of Agriculture concerned, the inventory was compiled by Mr. H. C. Sampson, Economic Botanist at Kew. The assistance of several specialists is acknowledged, including the staff of the Herbarium, Royal Botanic Gardens, Kew, who checked the names and authorities for the species included. The book serves a useful purpose in providing, in a concise form, information detailing the distribution of tropical and sub-tropical crop plants in the British Empire. This will prove of considerable value to agricultural officers who are concerned in the introduction of crop plants, especially of food crops and fruits to which the limitations of saturated markets for money crops do not apply.

The plant genera are arranged alphabetically and the species placed similarly in each genus. Mr. Sampson states that every effort has been made to give the correct name by which the species cited should be known. Agricultural officers in the tropics will appreciate this as, during the past few years, many changes in nomenclature have occurred. An appendix lists a number of common synonyms with reference to the name adopted in the text. No index of common or local names is provided but the index to commonly-used synonyms serves as a guide where changes in nomenclature have been adopted. Under each specific name is grouped the following information, (i) presumed country or countries of origin, (ii) common and vernacular name or names together with the country, or language employed, (iii) uses, (iv) countries in the British Empire where the crop is grown. The latter information is amplified under five headings, arranged in the crop's relative order of importance. This is briefly as follows:—(a) indigenous or early introduction, (b) successfully established, (c) still under trial, (d) introduced but cultivation abandoned, (e) introduced but failed to become established.

It is inevitable that in a compilation of this nature, inequalities in the relative importance of many crop plants will result. It is not, however, proposed to criticise the inventory in this review. Omissions and inequalities in respect of Malayan crop and economic plants occur but there should be little difficulty in

correcting these in a subsequent edition of the book, and arrangements that will provide for revision are proposed. The present bulletin will do much to stimulate interest in the geographical distribution of tropical and sub-tropical crops and enable the agricultural officer to obtain an idea of the climatic requirements of any particular crop. The use of the abbreviations S.S. and F.M.S. is not satisfactory; Malaya is the correct name for the peninsula, which in addition to the Straits Settlements and Federated Malay States includes several unfederated States. As an example it is stated (page 74) that *Elaeis guineensis*, the oil palm, is successfully introduced into the S. S. and F. M. S., whereas returns show that there is no planted area in the Straits Settlements. The total area of oil palms in Malaya is 65,000 acres, made up by 33,000 acres in the F.M.S., and 32,000 acres in the Unfederated Malay States, practically all of which is in the State of Johore.

The latter part of the book contains a series of notes on a variety of crops, principally staple food plants of the indigenous peoples of the Empire. The notes will serve as a useful guide in connexion with the comparative study of crop varieties. Twenty crops are included and at the end of each note a short bibliography refers to important literature dealing with the crop described. It is hoped that the scope of this section of the book will be extended in a further edition.

Mr. Sampson and his collaborators are to be congratulated on the production of this book, which again serves to remind those concerned in tropical agriculture, of the great assistance which the Royal Botanic Gardens, Kew, has always been so ready to provide.

J. N. M.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports by Agricultural Officers.

May, 1936.

The Weather.

The rainfall for May was heavier than usual for the month in most parts of Malaya, and heavy thunderstorms were experienced in Penang, the inland areas of Perak, Selangor and Pahang and in Kelantan. The flooding of roads occurred in parts of Perak and Selangor and of padi lands elsewhere, including parts of Pahang and Johore.

Exceptions to the general wet conditions were the coastal belt of Selangor as far north as Kuala Selangor and the east coast of Pahang, whilst in Malacca dull cloudy days and a normal rainfall prevailed. In a belt of country from Lumut to Kuala Kangsar in Perak, fairly dry conditions prevailed, but the Negri Sembilan coast and the Lower Perak coastal area appear to have shared in the somewhat heavier rainfall that was generally characteristic.

Remarks on Crops.

Padi.—The transplanting of seedlings commenced in the early areas of Batang Padang District of Perak, in the inland Districts of Selangor, the riverine mukims and Bentong District of Pahang and in the Kukup and Segamat Districts of Johore. Flood damage to planted padi is reported from the last named District and from the Samantan valley in Pahang, whilst planting has been impeded by floods in areas in Pahang and Johore. Preliminary ploughing has commenced in Kedah and Malacca and has made good progress on the dry-padi areas of Kelantan.

The efforts that have been made in Pahang to interest cultivators in cultivation of the land with the *tajak* are reported to be meeting with a certain degree of response in the river mukims of Lipis District.

In Stage II of the Sungei Manik area considerable progress is reported to have taken place in felling and clearing lands newly alienated, although the rate of progress and thoroughness of work varies with the origin of the Malays who occupy the land and with the Ketua in charge. Thus, on one portion occupied by Kuala Kangsar Malays and another occupied by Banjarese, progress is slower than on the remainder of the area, where it is anticipated that the felled jungle will be in a condition for burning by the specified date. The fact that such good progress has been made in clearing the jungle in readiness for planting in the coming season speaks well for the sound work done by the Colonization Officer and others, for it is the normal custom of the country to extend the clearing of timber over several seasons, the crop in the meantime suffering from the amount of felled

timber lying in the fields. On Stage I considerable progress has been made in the making of division bunds between lots and between the padi land and drains.

In the Panchang Bedena area felling and clearing was continued on some 5,000 acres. On other parts the making of bunds is being impeded by the amount of felled timber present on the land and by wet weather.

Rubber.—There was a slight decline in price for all grades at the beginning of the month, but a recovery towards the end of the month. A curious feature of this month's reports is an increase in price offered for uncouponed rubber in certain areas although there has been a general decline in the price for coupons. Thus, in south Perak uncouponed rubber realized $9.50 a picul, in Negri Sembilan the rise in price noted last month for uncouponed rubber was maintained, whilst in south Johore uncouponed rubber rose to $9 to $10 and was maintained at last month's price of $9 in north Johore. In Kedah there was a brisk demand for unsmoked rubber and a revival of a demand for scrap, which realized as much as $25 a picul.

Further activity in the erection of smoking cabinets is reported from Batang Padang in Perak, where four others are under construction, from Temerloh, where two new ones have been erected, whilst progress continues in Central Johore. Isolated cases are reported where cultivators have obtained sufficiently enhanced prices for good smoked sheet to make the work of smoking well worth while but, in general, the difficulty of obtaining from local dealers a fair price for the improved article is retarding any general adoption of smoking by small-holders.

In Pahang an arrangement was made with dealers some time ago to exhibit samples of various grades of rubber and the price offered for each. Reports to hand indicate that this is having a definite effect on improving the product offered for sale by many small-holders.

Copra.—Further investigation into particulars of the competition in Province Wellesley between kiln owners and buyers for the fresh nut trade has shown that the demand for the latter is variable and increases during or just before the third, sixth and ninth months of the Chinese year. During the month reviewed the variation in price for fresh nuts in the north of the Settlement was as great as $8.50 per 1,000 with a maximum of $22 and a minimum of $13.50, the higher prices obtaining in areas where buyers for fresh nuts were operating. Such kilns as were working did not turn out high-grade copra, but dried for one or two days only, it being claimed that the quicker turnover was more profitable than the premium obtained for a high-grade product with smaller turnover. Investigation is proceeding to ascertain if the establishment of twin cabinet kilns will be likely to improve the position.

In the Bagan Datoh area of Perak further demonstrations were given with the twin cabinet kiln erected for the purpose. One of this type has been erected by small-holders and commenced work and it seems probable that further kilns will be similarly erected in course of time. It is worthy of note that the few improved kilns of the Ceylon type that have been built in the Bagan Datoh area have

continued to produce four-day copra of good quality and one further brick kiln of this type was erected during the month.

In Selangor, a further decline in copra price is reported in Kuala Selangor but the price was maintained in Kuala Langat and Klang. It is recorded in the monthly report that the Klang copra is sold either to an estate or direct to shippers and very seldom are sales made to Chinese middlemen. In Sabak Bernam a continued improvement is reported to be evident in the palms protected by the bund.

In Johore, two demonstration cabinet kilns have been erected in Kukup and one in the Batu Pahat District and the initial working was satisfactory and gained the interest of local cultivators. At Sungei Kluang, in Batu Pahat, several producers evinced a desire for a kiln of a larger capacity than the 30-acre cabinet used for the demonstration. Investigations are in hand to ascertain if a satisfactory cabinet kiln of the large capacity desired can be designed. In north Johore, similarly, a cultivator has expressed satisfaction with a 30-acre cabinet kiln he has erected, but desires one of a larger capacity.

Pineapples.—In Selangor, the main fruit season has commenced and the price of $1.20 per 100 obtained for fruit compares favourably with prices of former years in this State. Fruit from Bukit Changgang in Kuala Langat District is being sent to Singapore where prices of $2.50 to $3.50 per 100 are being paid for them. A new factory at Bukit Changgang is nearing completion and the planting of a large area alienated for the crop at Sijangkang has commenced. Two factories were in operation during the month.

In Johore, the main fruiting season which commenced in April is proving disappointing, as both the size and quality of the fruit are below expectations. Prices have been maintained everywhere and have appreciated in Johore Bahru to $2.40 to $2.50 per 100 fruit. Eight factories were operating during the month.

Agricultural Stations and Padi Test Plots.

Agricultural Stations.—In Province Wellesley, alterations to lay-out on Bukit Mertajam Station were decided upon and put in hand, whilst progress was made with the planting programme at Ayer Itam. At Kuala Kangsar Station the pruning of coffee was done and the harvesting of pepper commenced. Leaf eating beetles proved troublesome in the fruit area. At Tanah Rata, Cameron Highlands, various improvements to roads and drains were effected and alterations in the position of some of the machines in the factory were made with a view to more convenient working. In Selangor, demonstrations in making China tea were given at Cheras Station, whilst at Telok Datoh Station a small store and plant house was in course of erection, and cultivation for pineapple planting was carried out. In Malacca, the replanting of the pineapple area was completed at Sungei Udang Station and further planting was done in the fruit extension area, whilst a poultry night ark and nesting boxes were erected for demonstration purposes and, at the Farm School, a small cabinet copra kiln was erected for a similar purpose. In

Pahang, good progress was made with the planting programme at Raub Station. In Johore, felling on the Pineapple Station was completed and the fencing of Tangkah Station was commenced and tuba cuttings planted in the nursery. At the Pineapple Station in Singapore twenty-seven fruits from original selections were harvested and records of weight, flavour etc. made. Some of these selections are very promising.

Padi Stations and Test Plots.—At Sungei Manik Station the bunding of the new area was completed satisfactorily and work was continued on making a drying floor near the store. Transplanting was carried out on Kajang Plot in Selangor, at Ulu Klawang Plot in Negri Sembilan, at Kerdau Plot in Pahang and on some of the Plots in Johore.

District Show.

The Ulu Selangor District Show held at Kuala Kubu on 31st May and 1st June was opened by the Hon'ble the British Resident, Selangor. All classes were well supported and, although the main fruit season had not commenced, the total number of exhibits in that section approximated closely to the figure for last year. A feature of the Show was the livestock competition, ten preliminary competitions having been held at suitable centres and the best goats and buffaloes selected to compete in the final judging at the Show. The padi section was divided into six classes, a separate class being provided for each of the five varieties most commonly grown in the District and a sixth class for any other varieties. The Department of Agriculture exhibit included two types of small-holders' rubber smoke cabinets which were erected on the Show ground and demonstrations given by Asiatic Rubber Instructors. Rural Lecture Caravan films were exhibited in the evening. The organization of the Show was good and the programme of entertainments arranged added materially to the success. The attendance was good.

An Agricultural Show at Parit, Perak, on 31st May was the first function of the kind to be held in the Sub-district for fourteen years. The Show was opened by H.H. the Sultan of Perak who was accompanied by the Hon'ble the Acting British Resident and the Raja Bendahara of Perak. As with the Ulu Selangor Show, the season was a little too early for fruits, and some of the exhibits in this class were immature. The fourteen sections provided included, apart from purely agricultural products, livestock, arts and crafts, cakes and preserved fruits, a baby show and exhibits by Sakai. Entries were numerous and of great variety. In respect of agricultural products the classes were more numerous than is desirable and it would have been an improvement if those of small account commercially had been omitted, which would have allowed of more attention being given to the important products. The padi and rubber sections were run in conjunction with the All-Malayan Competitions for these products. There were some 300 entries in the padi section and 38 in the rubber section and some of these exhibits were exceptionally good. The first prize for padi went to a cultivator of Paya Besar for a good exhibit of a Radin type, whilst a small-holder of Bota secured the first prize for a good exhibit of smoked sheet prepared on a smoke cabinet built

according to the Rubber Research Institute design. The livestock section was well represented and brought forth some good exhibits of poultry, goats and buffaloes. The parade for judging the last-named, which took place outside the precincts of the Show ground, drew an enormous crowd of spectators. The Department exhibit consisted of a full size rubber smoke cabinet, models of it and of improved types of poultry houses suitable for use by small-holders. The Show was very successful in respect of both entries and attendance and the Assistant District Officer and other local residents are to be congratulated upon the result of their work and efforts in organizing the function.

DEPARTMENTAL NOTES.

Retirement of the Hon'ble Dr. H. A. Tempany, C.B.E.

The Hon'ble Dr. H. A. Tempany, C.B.E., Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States, relinquished duty prior to retirement on 22nd May, 1936, and has been granted two months lèave. At the end of this period he will assume duty of his new appointment of Assistant Agricultural Adviser to the Secretary of State for the Colonies.

Mr. F. W. South, Chief Field Officer, has been appointed Acting Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States.

Mr. F. W. Birkinshaw, State Agricultural Officer, Perak, assumed duty as Acting Chief Field Officer on 20th May 1936.

Mr. D. H. Grist, Agricultural Economist and Editor, has been granted 8 months and 26 days leave on full pay with effect from 28th May, 1936. Mr. N. C. E. Miller, Assistant Entomologist, has been appointed Acting Agricultural Economist and Editor.

School of Agriculture, Malaya.

The School of Agriculture, Malaya, which reopened on 18th May, 1936, is now full to capacity and no fewer than 17 applicants for admission as private students have had to be refused for this reason during the past few weeks. Of the 80 boys in residence, 48 have been enrolled for the Two Years and 32 for the One Year Course. There are 48 Malays, 30 Chinese and 2 others. Thirty-nine are from the Federated Malay States, twenty-five from the Straits Settlements, fifteen from the Unfederated States and one from Sarawak.

It is unlikely that there will be any falling off next year in the demand for admission to the Two Years Course, and prospective candidates are, therefore, advised to make early application.

Coconut Experiment Station, Port Swettenham.

For the convenience of postal arrangemnts the Coconut Experiment Station, Klang, will, in future, be known as the Coconut Experiment Station, Port Swettenham.

Statistical.

MARKET PRICES.

May, 1936.

Major Crops.

Rubber.—The market weakened in the first week of the month, falling to 25 cents per lb.; a slight improvement occurred in the third week, but the price again eased at the close. Spot loose opened at 26$\frac{1}{8}$ cents per lb., falling to 25 cents on the 8th and 13th May; it improved to 26$\frac{1}{8}$ cents on the 16th May, and closed at 25$\frac{5}{8}$ cents per lb. The average price for the month for No. 1. X. Rubber Smoked Sheet was 25.63 cents per lb. as compared with the April average of 26.49 cents. The London average price was 7.32 pence per lb., and the New York price 15.55 cents gold, as compared with 7.53 pence and 15.92 cents gold in the previous month.

Prices paid for small-holders' rubber at three centres during May are shewn in the following table.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, May, 1936.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.				Kuala Kangsar, Perak.			Batu Pahat, Johore.			
	7	14	21	28	6	13	27	6	13	20	27
Smoked sheet	32.42	33.28	32.00	32.16	33.00	31.72	32.00	32.02		32.30	31.50
Unsmoked sheet	31.00	30.00	31.00	31.12	32.00	31.00	31.00	31.30	30.10	30.64	31.00
Scrap	27.10		28.00						26.90		27.00

Transport by F. M. S. R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang \$1.24 per picul, Seremban to Singapore \$8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway \$6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway \$10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent

No purchases at Kuala Kangsar on the 20th May.

Palm Oil.—The following table shews that the market for the Malayan commodities continued its downward trend.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1936.	Palm Oil in Bulk, c.i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
May 1	17. 0 0	8. 15. 0
„ 8	16. 5. 0	8. 15. 0
„ 15	16. 0. 0	8. 10. 0
„ 22	15. 17. 6	9. 0. 0
„ 29	15. 15. 0	9. 0. 0

Copra.—The market improved during the month, but prices did not reach the higher levels recorded earlier in the year. The sun-dried grade opened in Singapore at $4.50 per picul and rose to $4.95 on the 20th May; thereafter it fell to $4.90, and closed at $4.85, the monthly average being $4.77 as compared with $5.03 in April. The mixed quality averaged $4.50 per picul as compared with $4.59 in the previous month.

Copra cake fell to $1.35 per picul, the average for the month being $1.40 as compared with $1.55 in April.

Rice.—The average wholesale prices of rice per picul in Singapore in April were as follows:— Siam No. 2 (ordinary) $3.95, Rangoon No. 1 $3.45, Saigon $3.67, as compared with the March corresponding prices of $3.85, $3.30 and $3.60. April 1935 prices were $3.97, $3.65 and $3.87.

The average retail market prices in cents per gantang of No. 2 Siam rice in April were:—Singapore 28, Penang 28, Malacca 25, as compared with 30, 28 and 26 respectively in March.

The average declared trade value of imports of rice in April was $3.66 per picul, as compared with $3.56 in March, and $3.46 in February.

Padi.—The price of padi at Government Rice Mills, Perak, was reduced from $2.10 to $2 per picul on the 20th May, but only negligible purchases were made during the month. Retail prices of padi ranged from 5 to 14 cents per gantang in different parts of the country.

Pineapples.—Only slight variations were made in the prices fixed by the Packers' Combine and averages per case for the month were: Cubes $3.12, Sliced

Flat \$3.03, Sliced Tall \$3.10, as compared with \$3.16, \$3.07 and \$3.16 respectively in April.

Prices of fresh fruit per 100 were:—Selangor \$1 to \$1.80; Singapore \$2; Johore 1st quality \$1.80 to \$2.50, 2nd quality \$1 to \$2.10 (\$3 in Benut), 3rd quality 70 cents to \$1.80.

Beverages.

Tea.—Eleven consignments of Malayan tea were sold on the London market during May. Two consignments were of upland tea and averaged 1s. $0\frac{3}{4}$d. and 1s 1d. per lb. respectively; the nine consignments of lowland tea were sold at average prices ranging from $11\frac{1}{2}$d. to 1s. $0\frac{1}{2}$d. per lb.

Average London prices per lb. during May for tea consignments from other countries were as follows:—Ceylon 1s. 2.64d., Java 10.79d., Indian Northern 1s. 0.54d., Indian Southern 1s. 1.43d., Sumatra 10.29d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report,* 26th May, 1936, of the Colombo Brokers' Association, and are as follows (rupee cents per lb.):—High Grown Teas 72 cents, Medium Grown Teas 62 cents, Low Grown Teas 59 cents.

Coffee.—The price of Sourabaya coffee in Singapore during May improved to average from \$13 to \$14.07 per picul, but Palembang fell, averaging \$7 to \$7.94, as compared with \$7.10 to \$8.10 in April.

Prices of locally grown coffee ranged from \$9 to \$26 per picul.

Spices.

Arecanuts.—Singapore prices weakened considerably during May, the averages per picul being: Splits \$4.95 to \$5.96; Red Whole \$4.38 to \$5.75; Sliced \$7.15 to \$8.45.

The Singapore Chamber of Commerce average prices per picul were:—Best \$6.35, Medium \$5.90, Mixed \$4.49, as compared with \$6.12, \$5.58, and \$4.24 in April.

Pepper.—Nominal prices in Singapore were further marked down during May, and the averages of the quotations were: Singapore Black \$8.05, Singapore White \$15.80, Muntok White \$16.30 per picul.

Nutmegs.—Prices in Singapore were low at the beginning of the month but improved in the second half. Average prices per picul were: 110's \$27.50, 80's \$28.50, as compared with \$29.25 and \$30.25 respectively in April.

Mace.—Both Siouw and Amboina were quoted unchanged throughout the month at \$90 and \$75 per picul respectively. The April average prices were \$91.25 and \$75 per picul.

Cloves.—Zanzibar and Amboina continued to be quoted nominally at \$38 per picul.

Cardamoms.—Green cardamoms were quoted in the Ceylon Chamber of Commerce reports at Rs. 1.35 to Rs. 1.46 rising to Rs. 1.54 to Rs. 1.69 at the close.

Miscellaneous.

Tuba Root (*Derris*).—Decreased demand during May tended to lower prices slightly, and the Singapore market maintained a dull tone. Roots sold on rotenone content averaged \$51 per picul, and roots sold on a basis of ether extract averaged \$34 per picul. The April averages were \$52 and \$34.50 per picul respectively.

Gambier.—No. 1 Cube continued unchanged at \$10.50 per picul, but Block fell to \$5.25 at the close, with an average price for the month of \$5.55 per picul, as compared with \$6.25 in April.

Tapioca.—Prices in Singapore remained unchanged at: Flake, Fair \$5.50, Seed Pearl \$5.50, Medium Pearl \$6.50 per picul.

Sago.—Pearl, Small Fair, improved to \$3.90 per picul throughout the month, as compared with \$3.80 in April. Flour, Sarawak Fair, weakened slightly to average \$2.26 per picul as compared with \$2.30 in April.

Tobacco.—Prices of locally grown tobacco were high in Kelantan, being: 1st quality \$110 to \$120 per picul, 2nd quality \$80, 3rd quality \$60. Elsewhere the range was: 1st quality, \$20 to \$45, 2nd quality \$15 to \$25, 3rd quality \$10 to \$16.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Kohyei & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross. London, S.W.1.

GENERAL RICE SUMMARY *

April, 1936.

Malaya.—April imports of foreign rice were 55,952 tons, and exports 13,511 tons. Net imports during January to April aggregated 166,027 tons, an increase of 14.5 per cent. as compared with 1935†

Of the imports during April, 49 per cent. were consigned to Singapore, 20 per cent. to Penang, 6 per cent. to Malacca, 21 per cent. to the Federated Malay States, and 4 per cent. to the Unfederated Malay States. Of the total, 60 per cent. came from Siam, 33 per cent. from Burma, 6 per cent. from French Indo-China, and 1 per cent. from other countries.

Of the April exports, 76 per cent. were consigned to the Netherlands Indies, and 24 per cent. to other countries. The various kinds of rice exported were (in tons, percentages in brackets):— Siam 9,371 (69.4), Burma 3,415 (25.3), French Indo-China 567 (4.2), parboiled 42 (0.3), local production 116 (0.8).

India and Burma.—Foreign exports during the first quarter of the year totalled 386,000 tons, as compared with 630,000 tons in 1935, a decrease of 38.7 per cent. Of these exports 4.7 per cent. were to the United Kingdom, 18.9 per cent. to the Continent of Europe, 30.8 per cent. to Ceylon, 18.4 per cent. to the Straits Settlements and the Far East, and 27.2 per cent. to other countries. The corresponding percentages for 1935 were 4.6, 9.4, 20.3, 36.2 and 29.5.

Burma's total exports of rice and bran (*Bangkok Times*, 4th May, 1936) from the 1st January to the 28th March were 961,259 metric tons, as compared with 1,135,147 metric tons in 1935, a decrease of 15.3 per cent.

Siam and Japan.—The latest information available was published in the March Summary.

French Indo-China.—Entries of padi into Cholon during the first four months of the year totalled 672,181 metric tons, a decrease of 15.7 per cent. as compared with 797,461 metric tons in 1935. Exports of rice for the same period decreased by 24 per cent. from 811,102 metric tons in 1935 to 616,584 metric tons in 1936.

Netherlands Indies.—The latest information available was published in the February Summary.

Ceylon.—Imports during the first four months of the year totalled 186,435 tons, an increase of 8.2 per cent. as compared with 172,326 tons in 1935.

Europe and America.—Shipments from the East to Europe during the period 1st January to 10th April were 289,365 tons, an increase of 30.5 per cent. when compared with 221,736 in 1935.

Shipments for the Levant from the 1st January to 8th April were 4,891 tons, a decrease of 68.1 per cent., and to Cuba, West Indies and America 67,010 tons, an increase of 17.3 per cent.

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* Abridged from the Rice Summary for April, 1936, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935.

MALAYAN AGRICULTURAL EXPORTS, APRIL, 1936.

PRODUCT.	Net Exports in Tons				
	Year 1935	Jan.-April 1935	Jan.-April 1936	April 1935	April 1936
Arecanuts ...	21,588	8,250	10,651	2,437	2,758
Coconuts fresh † ...	106,272†	31,924†	37,772†	9,099†	11,408†
Coconut oil ...	35,911	9,799	14,384	2,528	3,986
Copra ...	111,752	39,080	21,441	8,714	4,401
Gambier, all kinds ...	2,837	931	762	259	246
Oil cakes ...	11,361	2,691	4,028	456	1,073
Palm kernels ...	3,892	1,071	1,293	246	310
Palm oil ...	24,598	7,092	7,605	2,669	3,205
Pineapples canned ...	73,923	20,489	22,277	5,615	6,570
Rubber ¶ ...	378,381¶	131,468¶	112,306¶	34,680¶	28,307¶
Sago,—flour ...	10,920	4,595	1,450	869	1,908
,, —pearl ...	4,655	1,486	1,001	376	294
,, —raw ...	7,735*	2,127*	2,745*	404*	672*
Tapioca,—flake ...	1,953	582	687	78	187
,, —flour ...	755*	305*	630*	30	201*
,, —pearl ...	17,169	4,850	5,002	1,856	1,947
Tuba root ...	567	177	246	43½	58

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION (IN TONS) OF PALM OIL AND KERNELS

(As declared by Estates)

Month 1936	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S
January ...	1,395.4	326.5	258.6	37.2
February ...	1,531.9	372.4	244.2	54.6
March ...	1,878.4	534.5	302.9	88.0
April ...	1,410.6	446.8	250.0	80.0
Total ...	6,216.3	1,680.2	1,055.7	259.8
Total January to April 1935 ...	4,152.2	1,222.4	659.5	177.1
Total for year 1935 ...	17,338.7	5,764.6	2,711.1	818.4

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 30TH APRIL, 1936.

State or Territory	Acreage of Tappable Rubber end 1935	Estates which have entirely ceased tapping		Estates which have partly ceased tapping (a)		Area of Tappable Rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,526	1,125	2.5	16,832	37.8	695	1.6	17,957	40.3
Malacca	121,601	3,563	2.9	34,307	28.2	3,525	2.9	37,870	31.1
Penang Island	2,575	130	5.1	449	17.4	284	11.0	579	22.5
Singapore Island	34,525	3,919	11.4	10,369	30.0	417	1.2	14,288	41.4
Total S.S. ...	203,227	8,737	4.3	61,957	30.5	4,921	2.4	70,694	34.8
FEDERATED MALAY STATES :—									
Perak	294,988	14,234	4.8	72,735	24.7	14,923	5.0	86,969	29.5
Selangor	332,165	13,756	4.1	75,756	22.8	16,867	5.1	89,512	26.9
Negri Sembilan	258,304	16,313	6.3	54,975	21.3	17,093	6.6	71,288	27.6
Pahang	77,210	11,956	15.5	27,133	35.1	18,229	23.6	39,089	50.6
Total F.M.S. ...	962,667	56,259	5.8	230,599	24.0	67,112	7.0	286,858	29.8
UNFEDERATED MALAY STATES :—									
Johore	432,443	27,031	6.2	68,216	15.8	39,044	9.0	95,247	22.0
Kedah	199,607	3,880	2.0	22,423	11.2	19,349	9.7	26,303	13.2
Kelantan	30,474	403	1.3	10,280	33.8	5,424	17.8	10,683	35.1
Trengganu (b)	4,643	Nil	Nil	15	0.3	179	3.9	15	0.3
Perlis (c)	1,575	Nil	Nil	653	41.5	59	3.7	653	41.5
Brunei	6,010	Nil	Nil	2,582	43.0	856	14.2	2,582	43.0
Total U.M.S. ...	674,752	31,314	4.7	104,169	15.4	64,911	9.6	135,483	20.1
TOTAL MALAYA ...	1,840,646	96,310	5.2	396,725	21.6	136,944	7.4	403,035	26.8

Notes :—(a) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(b) Registered Companies only.
(c) Rendered quarterly.

MALAYAN RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF APRIL, 1936, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January to April 1936		during the month		January to April 1936						
	Ports	Dealers	Estates of 100 acres and over	during the month	January to April 1936	during the month	January to April 1936	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to April 1936
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	5,224	12,631	9,021	37,851	4,791	19,587	Nil	Nil	Nil	Nil	10,274	2,569	43,065	14,052	...	7,983	10,834	7	28
Johore ...	...	1,599	4,116	3,904	15,665	3,974	11,997	Nil	93	Nil	191	1,507	5,590	7,935	19,183	...	2,565	4,024	...	...
Kedah ...	...	124	3,272	2,223	9,949	992	2,473	Nil	Nil	Nil	Nil	1,283	2,339	5,106	7,892	...	337	2,652	...	...
Perlis ...	...	4	20	12	45	25	82	Nil	Nil	Nil	Nil	Nil	28	Nil	118	...	14	19	...	...
Kelantan ...	...	271	383	248	1,076	598	2,088	Nil	Nil	Nil	Nil	207	802	623	2,601	...	259	232	...	...
Trengganu ...	...	55	50	137	833	68	417	Nil	Nil	Nil	Nil	Nil	205	Nil	1,250	...	55	50	...	...
Brunei ...	...	3	46	24	161	77	238	...	...	...	...	...	118	...	420	...	8	24	...	...
Total Malay States	...	7,280	20,518	15,569	65,580	10,525	36,882	Nil	93	Nil	191	13,271	11,651	56,729	45,516	...	11,221	17,835	7	28
S. SETTLEMENTS :—																				
Malacca ...	...	1,409	1,269	929	3,930	498	2,167	Nil		Nil		1,506		8,583		...	2,069	1,187	...	...
Province Wellesley	...	480	571	376	1,522	186	821	Nil		Nil		5,273		29,454		...	1,036	527	...	...
Penang ...	1,500	4,968	6	15	64	19	284	1,732	10,950	10,147	43,724		Nil		Nil	1,035	5,299	8	...	...
Singapore ...	3,565	19,289	162	140	578	39	418	12,889		47,706		16,201		65,574		4,127	21,739	191	20	84
Labuan ...	...	28	Nil	Nil	Nil	11	60	81		314		Nil		Nil		...	16	Nil	...	...
Total Straits Settlements ...	5,065	26,174	2,008	1,460	6,094	753	3,750	14,702	10,950	58,167	43,724	22,980	Nil	103,611	Nil	5,162	30,159	1,913	20	84
Total Malaya ...	5,065	33,454	22,526	17,029	71,674	11,278	40,632	14,702	11,043	58,167	43,915	36,251	11,651	160,340	45,516	5,162	41,380	19,748	27	112

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	6,970	20,952	4,974	2,721	2,278	150
WET RUBBER	1,013	787	325	408	287	187
TOTAL ...	7,983	21,739	5,299	3,129	2,565	337

TABLE III
FOREIGN EXPORTS

PORTS 29	For month 30	January to April 1936 31
Singapore ...	22,859	99,752
Penang ...	8,404	41,427
Port Swettenham.	4,717	18,211
Malacca ...	271	950
MALAYA ...	36,251	160,340

TABLE IV
DOMESTIC EXPORTS 4

AREA 32	For month 33	January to April 1936 34
Malay States ...	24,922	102,245
Straits Settlements	1,982	9,321
MALAYA ...	26,904	111,566

Notes:—
1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 22nd May, 1936.

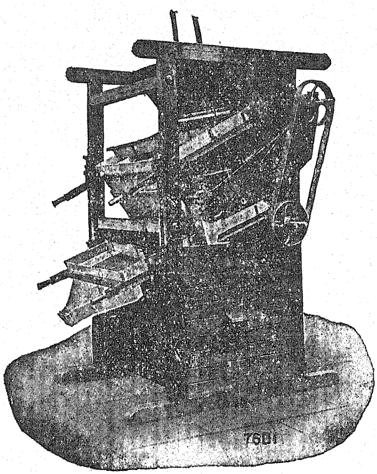
METEOROLOGICAL SUMMARY, MALAYA, APRIL, 1936.

Locality.	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B.	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total	Total	Most in a day. Amt.	Number of days: Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total.	Daily Mean.	Per cent.
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	92.7	73.2	82.9	96	70	86	76	85.5	85.8	13.67	347.2	3.42	18	14	6	5		211.95	7.07	58
Bukit Jeram, Selangor ...	89.7	73.6	81.7	92	72	87	75	85.7	87.1	3.22	81.8	1.10	15	11				243.30	8.11	66
Sitiawan, Perak ...	90.8	74.5	82.7	93	72	87	77	84.6	84.6	5.24	133.1	1.40	16	11	1			229.70	7.66	63
Temerloh, Pahang ...	90.5	73.1	81.8	94	71	86	77	86.2	85.7	10.38	263.7	2.04	19	16	3	2		223.30	7.44	61
Kuala Lipis, Pahang ...	90.7	71.9	81.3	93	70	89	74	85.3	85.0	7.26	184.4	1.82	20	18		16		211.75	7.06	58
Kuala Pahang, Pahang ...	87.3	75.3	81.3	89	73	84	80	85.5	85.2	6.54	166.1	1.24	15	11				231.30	7.71	63
Kallang Aerodrome, S'pore ...	87.0	76.2	81.6	90	74	81	79	82.5	83.4	7.00	177.8	2.08	18	11	4			184.70	6.16	50
Butterworth, Province Wellesley ...	89.5	75.0	82.3	91	72	87	77	87.2	86.3	4.40	111.8	2.10	18	13				253.05	8.43	69
Bayan Lepas Aerodrome Penang ...	89.0	75.3	82.1	91	73	87	78	86.0	85.6	10.76	273.3	2.86	19	18	5			241.00	8.03	66
Bukit China, Malacca ...	87.5	74.4	80.9	91	73	82	77	84.9	85.0	5.69	144.5	2.02	14	10	3		1	208.75	6.96	57
Kluang, Johore ...	89.7	72.0	80.9	93	70	85	74	82.6	82.4	11.06	280.9	2.92	23	19	9	8		175.20	5.84	48
Bukit Lalang, Mersing, Johore	86.3	72.6	79.5	91	70	80	74	82.3	81.5	7.36	186.9	3.36	18	14	2			227.00	7.57	62
Alor Star, Kedah ...	90.8	74.9	82.9	94	72	87	77	87.3	86.1	9.46	240.3	2.48	23	15	7	2		258.75	8.63	71
Kota Bahru, Kelantan ...	89.2	74.2	81.7	94	72	80	76	84.3	84.0	7.64	194.1	4.05	10	9	1			259.20	8.64	71
Kuala Trengganu, Trengganu	88.0	73.8	80.9	91	72	84	76	83.9	84.1	12.78	324.6	3.85	16	15		1		259.30	8.64	71
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	75.2	63.4	69.3	80	61	70	67	73.9	73.2	10.72	272.3	1.83	24	19		14		164.80	5.49	45
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	75.3	57.8	66.5	78	53	71	62	71.2	70.1	16.83	427.5	2.70	24	24	3	2		168.00	5.60	46
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.3	60.2	65.7	76	57	68	62			16.68	423.7	2.52	25	24	3	3		184.00	6.13	50

PALM OIL MACHINERY

PALM KERNEL SEPARATING

(Dry Process)



The "Wilder" Patent Dry Separating Machine for Palm Kernels (Patent No. 13530/27), as illustrated, is an improvement upon any hitherto known method, and will mechanically separate Palm Kernels from shell, the separated product containing under 3% of shell, whilst under certain conditions less than 1% of shell is found with the kernels.

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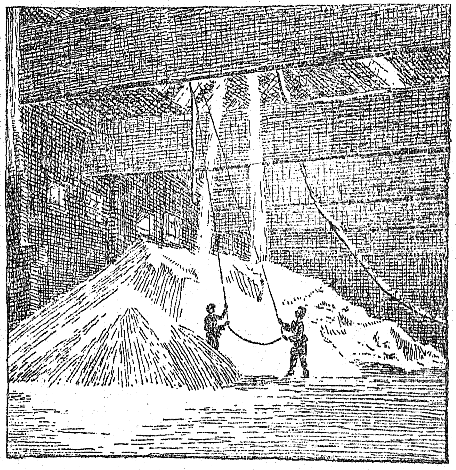

Shower of Sulphate of Ammonia in Silo At Billingham

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The Adviser on Agriculture invites those interested to visit the Central Experiment Station and the School of Agriculture, Serdang, and also the other Experiment Stations, Agricultural Stations, Farm Schools, Padi Experiment Stations, and Padi Test Stations of the Department in various parts of the Straits Settlements and Federated Malay States.

Agricultural Stations and Padi Test Stations also exist in certain of the Unfederated Malay States, to which visits are welcomed by the State authorities.

Intending visitors to the Central Experiment Station should communicate with the Senior Assistant Agriculturist in charge, and to the School of Agriculture with the Principal.

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Other Stations are listed below together with the addresses of officers to whom enquiries should be sent.

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AGRICULTURAL SERIES.

DEPARTMENT OF AGRICULTURE, S.S. & F.M.S.

Agricultural Leaflet No. 12.

CLOVES

(EUGENIA AROMATICA)

Published by the Department of Agriculture, Straits Settlements and Federated Malay States, Kuala Lumpur, F.M.S. and Printed by Caxton Press Ltd. Kuala Lumpur.
June, 1936.

CLOVES

(*Eugenia aromatica*)

Description.—A small-sized tree, attaining a height of 25 to 40 feet. The stem is generally forked and has several erect main branches. The smaller branches do not spread widely so that the tree is bushy and cone-shaped. Cloves are stated to be native of several islands of the Moluccas.

The flowers are borne in groups of three in paniculate cymes. Cloves of commerce consist of the dried unopened flower buds of the tree. The buds consist of a fleshy, sub-cylindrical base crowned with four thick calyx teeth and four lighter coloured petals, which are wrapped together containing the style surrounded by stamens. Good cloves are a rich reddish-brown colour, with fine aroma and flavour. They should be plump in appearance and complete with their crowns.

Cloves owe their aromatic properties to a volatile oil known as oil of cloves, the proportion of which varies from 16 to 19 per cent. by weight. The essential constituent of oil of cloves is a compound known as eugenol. Clove oil is used in perfumery, in soaps, for medicinal purposes, and in the manufacture of vanillin.

Formerly this crop was of considerable importance in Malaya, particularly in Penang and Province Wellesley, but, owing to damage by pests and diseases and competition from rubber planting, its value has become greatly reduced. At the present time about 85 per cent. of the world's production of cloves is from Zanzibar and Pemba. A smaller production comes from Madagascar, and also from the Netherlands Indies and Penang. Returns show that about 350 acres are under cultivation with cloves on Penang Island. Cloves from Penang are always at a premium since, in appearance, they are large and plump and of a bright reddish colour. They have been described as the best cloves in the world.

Soil and Situation.—The most suitable soils are well-drained friable clay loams capable of retaining moisture; stiff clays that harden during dry weather are less favourable. The clove tree is very sensitive to excessive ground water, and fails entirely in badly drained, stiff clay soil. It is stated that examination of soils in Zanzibar demonstrates that the tree is tolerant of acidity. The tree is shallow-rooted and the conservation of fertility in the top 18 inches of soil is of great importance. The root system is mainly superficial, consisting of a network of subsidiary roots and rootlets, spreading to a radius of 15 to 25 feet and descending to a depth of 12 to 15 inches. This shallow-rooting habit causes

the clove tree to be very susceptible to drought, especially in the early stages. In Penang, cloves are cultivated on hills from 200 to 2,000 feet above sea level, with the greatest success at the higher levels. At the Central Experiment Station, Serdang, considerable success has been obtained with this crop on the Hill Quartzite soil of the plains. Although the clove is generally considered an insular plant and established plantations are commonly near the sea, results to-date at Serdang with twelve-year-old trees, demonstrate that it may be grown inland and on the plains, provided soil conditions are suitable.

Propagation.—After flowering, the lower part of the flower swells and develops into a fleshy, one-seeded drupe, purple in colour and about 1 inch long, crowned by the persistent calyx teeth and style. The period between opening of the flower and ripening of the fruit is approximately four months. The weight of mature fruits is variable, ranging from 100 to 150 per pound; the hulled seed is about one-third of the entire fruit. The drupe consists of the interior cotyledons enclosing the embryo surrounded by a fleshy mesocarp, and exocarp. At Serdang, the whole fruit is sown but in Zanzibar the hulled seed is favoured. These are lightly pressed into the soil in a vertical position with the radicle pointing downwards. On a plantation scale, the seed is planted in prepared beds under shade, at a distance of 6 inches by 6 inches, and the seedlings partially hardened before transplanting. Although very sturdy seedlings may be raised by this method, serious difficulties arise when the plants have to be transplanted and many casualties occur in the field. The best results have been obtained at Serdang by placing fresh fruits in boxes of prepared soil. The fruits are closely spaced and kept under shade.

Germination takes place in twenty days and is completed in two months, when 75 per cent. germination or more is obtained. Powers of germination are short-lived and the fruits should be planted as soon as collected from below the trees. When the seedlings have two or three pairs of leaves, they are carefully lifted from the seed boxes and transplanted into bamboo joints. It is important to transplant the young seedlings before the tap root has become elongated and twisted. The bamboo joints containing the seedlings are then placed on a firm surface under shade, sufficiently high to permit of watering. With suitable treatment the young plants attain a height of 6 inches within nine months from germination, and carry about ten pairs of leaves. The overhead shade is then gradually reduced and the plants are ready for planting in the field.

Planting.—Seedlings having about ten pairs of leaves are planted in their permanent situations in the field during the rainy season. The first half of November is the best time to plant, as the seedlings then have the full advantage of the long wet season; it also permits supplying during the following short wet season which may occur in April and May. The planting distance adopted at Serdang is 20 feet by 20 feet triangular, allowing 124 trees per acre. There are possible objections to this spacing since it is unnecessarily wide in the early stages of growth, and probably too close when the trees mature. In Zanzibar, closer planting is suggested with subsequent thinning, giving an ultimate stand of 48 trees to the acre. On hill land in Malaya the former planting distance is recommended.

To encourage the seedlings to make maximum growth, large planting holes should be provided. Holes 2 feet by 2 feet square and 2 feet deep are recommended. The sub-soil is removed and replaced by a mixture of well-rotted cattle manure, or other organic matter, and surface soil. Experience gained at Serdang shows that unless the seedlings are liberally treated at time of planting, a fairly high percentage of plants die after transplanting in the field. This loss of young plants occurs for about twelve months subsequent to planting. Aided by liberal manuring, clove trees can be established on land that has been opened up from jungle for some years and has grown other crops. After planting, the seedlings are shaded with jungle herbage placed securely round the plants. Even with the greatest care, considerable difficulty is experienced in establishing a satisfactory stand of trees and consequently supplying is necessary. An adequate number of seedlings should be retained for this purpose.

Cultivation.—Investigations have been conducted at Serdang to ascertain whether overhead shade is beneficial with this crop in Malaya. Shade trees have a drawing effect on the clove tree and there appears no advantage in their use. It is important to encourage a rounded bushy crown with branches almost to the ground in order to permit maximum flowering and facilitate harvesting. On the other hand, the question of soil erosion is an important one and must receive consideration. Some form of undergrowth is necessary to protect the soil from erosion and maintain a degree of surface fertility. A number of shrubby leguminous plants may be employed for this purpose *e.g. Crotalaria anagyroides*, *C. usaramoensis*, and *Tephrosia candida.* Two to three rows of such plants should be sown between the rows of clove trees and kept in good condition by periodical pruning. The slopes of Penang hills are exceedingly steep, but

soil wash is prevented to some extent by the numerous granite boulders present. The Chinese growers commonly use the granite rock to build up terraced walls on the lower side of the clove trees with the object of supporting the trees and minimizing erosion.

Since the clove tree forms a mat of roots just below the surface of the soil, competition from weeds or cover crops in the immediate vicinity of the bush must be prevented. For the same reason, hand-weeding should be performed below the trees in preference to the use of implements.

Although information on the manuring of the clove tree is meagre, the tree undoubtedly responds to manurial treatment. At Serdang, young bushes have shown considerably improved growth as a result of applying 3 ounces of sulphate of ammonia in a shallow circular trench well away from the feeding roots of each tree. The following mixture of fertilizers is suggested for mature trees; sulphate of ammonia, 2 parts; rock phosphate, 5 parts; sulphate of potash, 2 parts. An annual application of 3 to 5 lbs. of this mixture should be turned below the soil well away from the mat of roots below each tree. The production of heavy crops is accomplished by Chinese growers in Penang by liberal dressings of prawn refuse (analysing 3.5 to 4.5 per cent. nitrogen, 5.5 to 11.5 per cent. phosphoric acid); as much as 25 lbs. a tree is often applied annually.

Harvesting.—Young trees commence to produce small crops when six or seven years old. A flush of young leaves appears, followed by the flower buds. These are green at first but finally turn yellowish with a red tint, at which stage they are fit to gather. The buds are gathered by hand, with the assistance of light ladders and hooked sticks. Since all the buds do not ripen at the same time, it is necessary to go over the trees several times during the harvest season. Flowering shows considerable variation in intensity and occurs locally from January to August with the main crop during May to August. The periodicity of flowering is governed by factors whose nature is imperfectly understood.

Yields.—The yield of dry cloves from eight-year old trees is about $3\frac{1}{2}$ lbs. per tree, which rises to about 5 lbs. per tree. It is difficult to estimate yields per acre since it is unusual to find a complete stand of bearing trees, and yields vary from year to year. Under favourable conditions an annual return of 3 to 4 piculs (1 picul = 133 1/3 lbs.) per acre may be obtained. Large trees in Penang which have been heavily manured are stated to yield as much as 15 lbs. of dry cloves per tree.

Preparation and Uses.—The freshly collected flower buds are sun-dried for one week on mats or concrete barbacue. It is stated

that, in Zanzibar, during wet weather excellent results are obtained by drying cloves in copra kilns; with careful firing drying is completed in twelve to fifteen hours, and the cloves so treated realize a premium over those sun-dried, because of their brightness. The weight of dried cloves is about 30 per cent. of the harvested flower buds. Care in sorting out all stalks and extraneous matter and grading by hand is undertaken for export.

In addition to their use as a flavouring spice, cloves are employed in European and Malay medicine. Oil of cloves is obtained by distillation; about 17 per cent. from the cloves, 5 to 6 per cent. from the stems and seeds, and 4.5 per cent. from the leaves, all on dry weight, is secured.

General Considerations.—Since there is a local demand for this spice, there appears no reason why clove planting should not be extended in Malaya. Low prices for many years have prevented any extension of planting on a large scale, but it is considered that, in suitable localities, the small-holder might plant the clove tree with profit. Preparation is a simple procedure and the crop may be kept in a dry place without deterioration.

References.—Articles containing information on cloves are obtainable from the Agricultural Economist and Editor, Department of Agriculture, S.S. and F.M.S., Kuala Lumpur.

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AGRICULTURAL SERIES.

DEPARTMENT OF AGRICULTURE, S.S. & F.M.S.

Agricultural Leaflet No. 14.

SWEET POTATO

(*IPOMOEA BATATAS*)

Published by the Department of Agriculture, Straits Settlements and Federated Malay States, Kuala Lumpur, F.M.S. and Printed by Caxton Press Ltd. Kuala Lumpur.
June, 1936.

SWEET POTATO

(*Ipomoea batatas*)

Description.—The sweet potato is a trailing herbaceous perennial, with edible starchy tubers, belonging to the family Convolvulaceae. The stems grow to a considerable length and root freely at every node that rests on the ground. It is commonly grown as a food-crop in tropical regions in both hemispheres with a range of cultivation extending into the sub-tropics. There is much variation in the types met with both as regards the shape and colouration of the leaf, stem, flower, and tuber, and also the colour of the flesh of the latter. The leaves are ovate, angular or lobed.

The flowers are white or pale pink. Although many varieties of sweet potato flower freely in Malaya, seed is rarely produced, due apparently to the flowers being to a great extent self-sterile. Seed has, however, been observed and this is probably the result of cross-pollination between varieties, effected through the agency of bees.

The shape of the tubers is generally either globular or cylindrical, but is variable and dependent to some extent upon soil conditions. The colour of the flesh of the tubers is either white, cream, or yellow to purplish-yellow. The weight of individual tubers varies, but ranges from half to one pound or over.

Varieties.—There appear to be four distinct varieties cultivated locally by Chinese. These may be distinguished by vegetative characters but there are other differences, the two most important being colour of the tubers and maturation period. Two of the varieties mature in three months or so, whereas the other two take five months. There are probably other local forms but the above are commonly met with in Selangor. The local variety most esteemed as food for human consumption is one with large tubers 6 to 7 inches long and 3 inches in diameter, cylindrical but rather irregular in shape. The skin is pale pink, flesh yellow, blotched orange in the centre. The flesh is sweet. This type is stated to take 110 days to mature and to be productive only on newly-opened land. Other varieties are grown on poor mining land, both for eating and for feeding pigs. One of these varieties has a deep pink skin with white flesh, and takes 150 days to mature. Its flesh is firm and of good flavour and is more readily saleable locally than any other kind. The Department of Agriculture made a number of introductions of sweet potatoes some twelve years ago from the West Indies, United States of America, Java, and Philippine Islands. The best of these, after trial, have been

widely distributed throughout Malaya. Three introductions of merit are North No. 3, Southern Queen, and Samar Big Yellow. These varieties take 4 to 5 months to mature, and produce tubers of very good flavour. The flesh of the first two named is white and the other yellowish-purple.

Uses.—The Chinese cultivate the sweet potato extensively in Malaya both for home consumption and sale in the local markets. Much use is made of the foliage for feeding pigs, the young vines being chopped up and boiled with rice bran and fed in a wet state. Analyses conducted by the Chemical Division of the Department of Agriculture show that sweet potato vines have possibilities as a constituent of rations for milch cows in cases where extra proteins and minerals are required. The vines are more succulent than guinea grass, but, while similar in protein and mineral content, avoid the corresponding increase in nitrogen-free-extract and fibre that further additions of guinea grass would involve. The sweet potato is a most valuable food-crop to the Chinese cultivator and suits admirably his system of small farming in Malaya.

For eating, the tubers are boiled shortly after harvesting. The keeping qualities of this crop are not good and various devices are adopted in sub-tropical countries, with a short-growing season, for storing the whole tubers. In Malaya, the tubers are generally consumed in a fresh state as cropping is continuous, but they may be sliced and dried, and thus kept for subsequent use, when required. This vegetable has never become popular with Europeans in Malaya, who prefer the ordinary potato. The sweet potato tubers contain about 70 per cent. of water and 20 to 25 per cent. of starch. Alcohol can be manufactured from the tubers, which, when in good condition contain 25 per cent. of fermentable matter.

Investigations conducted by the Chemical Division of the Department of Agriculture to determine whether young sweet potato vegetation contains dangerous quantities of prussic acid, shewed that neither variety is liable to cause poisoning to stock.

Soil and Situation.—The main requirement of the sweet potato is a well-cultivated friable soil that will permit of maximum tuber development. The Chinese frequently grow it in very sandy soil, relying on copious applications of liquid pig-manure to provide sufficient plant nutrients. Under such conditions the crop grows well and production of tubers is not arrested by excessive vegetative growth. Too much organic matter in the soil results in

very heavy growth of vines and small tubers. Artificial fertilizers are little used with this crop in Malaya and in ordinary circumstances their cost would be prohibitive. On light soils, a leguminous cover plant might be grown and turned into the land together with 150 lbs. rock phosphate and 50 lbs. sulphate of potash per acre. Potash is generally considered necessary owing to the heavy ratio of carbohydrates which the plant has to produce. Cattle manure at rates ranging from 10 to 15 tons per acre have given satisfactory yields at the Central Experiment Station, Serdang. Ridge culture is generally preferable, and the heaviest yields of tubers are secured by this means. The ridges should be spaced about three feet apart and raised to a height of eighteen inches or more. Since the crop is a hardy one and not subject to disease it proves very useful to the Chinese cultivator in assisting to bring land into cultivation for vegetables or other market garden produce.

Propagation.—The sweet potato is propagated from cuttings of semi-mature portions of the stem. Chinese cultivators always use apical cuttings, since earlier growth and heavier yields are obtained than in the case of middle or basal cuttings. If insufficient tips are available for planting, middle cuttings may be used; basal cuttings, however, should not be planted. It is interesting to record that experimental work in the Philippine Islands confirms this practice and advises the recommendations made. The cuttings should be nine to twelve inches long with six or more nodes; the leaves and petioles are removed from the lower portions of the stem which is to be inserted in the soil. The usual distance of planting is 15 inches apart in the rows. The soil should be in a moist state when planting the cuttings, which, with suitable conditions produce roots very readily. The cuttings are planted about 4 inches deep with several nodes below the soil. The earth must be well pressed round the stems of the cuttings to prevent them drying out. When a small supply of tubers only is required, planting is undertaken at intervals of two to four weeks in order to induce a sequence of cropping.

Owing to the difficulties of transporting sappy cuttings for long distances in this country, the use of small tubers is the most satisfactory method of distributing stock. These may be planted in small beds of sandy soil and cuttings taken as they become available.

Cultivation.—Weeding is necessary in the early stages of growth but once the plants become established the thick cover thus formed will prevent weeds growing in any appreciable

quantity. The trailing stems of the plants should be turned back on to the ridges periodically to inhibit excessive rooting with a consequent decrease in size of the main root tubers.

Harvesting.—The time for harvesting the tubers is best ascertained by lifting a few roots and examining them; if when they are cut through, the sap dries rapidly forming a white crust, they are mature. The age of maturity depends upon the variety grown. Should the tubers be left in the ground too long they become very liable to attacks of the sweet potato weevil, *Cylas formicarius.* The adult weevils puncture the skin of the tubers and damage the flesh. This pest also becomes prevalent when sweet potatoes are grown on the same land twice in succession. Sweet potatoes should therefore be grown in rotation with other crops. The most satisfactory tool for harvesting the crop is the Assam fork, by which means the tubers may be lifted with the minimum amount of damage. The tubers should be cleaned of all soil and stored in a cool place.

Yields.—At the Central Experiment Station, Serdang, numerous experimental plantings have been made over a number of years. Yields of good-cropping varieties are found to average from 4 to 5 tons of tubers per acre. Under favourable conditions, on newly-opened land cultivated by Chinese small-holders, yields of 6 tons per acre have been recorded. When removed at time of harvesting the tubers, the amount of fresh green matter obtained is approximately 4 tons per acre. With periodical cutting, an increased amount of vines might be obtained.

Reference.—An article containing information on sweet potatoes is obtainable from the Agricultural Economist and Editor, Department of Agriculture, S.S. and F.M.S., Kuala Lumpur.

The Experimental Cultivation of Sweet Potatoes at the Government Plantation, Serdang. *Malayan Agricultural Journal,* Vol. XV, No. 1, price 50 cents.

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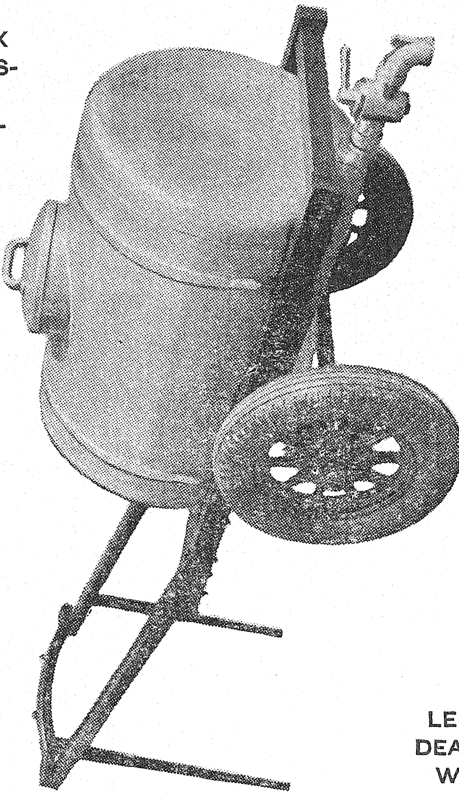

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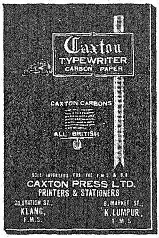

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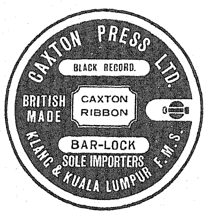

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Dr. H. A. Tempany, C.B.E.

RETIREMENT OF Dr. H. A. TEMPANY, C.B.E.

DIRECTOR OF AGRICULTURE, STRAITS SETTLEMENTS, AND ADVISER ON AGRICULTURE, MALAY STATES.

This is the last number of the *Malayan Agricultural Journal* in which the name of Dr. H. A. Tempany, C.B.E., F.I.C., F.C.S., will appear in the staff list of the Department of Agriculture, S.S. and F.M.S., of which he has been the Head during the last seven and a half years. We take this opportunity of placing on record the valuable work which Dr. Tempany has done for the improvement of local agriculture and also to congratulate him on his appointment as Assistant Adviser on Agriculture to the Secretary of State for the Colonies.

Dr. Tempany came to this Department in February, 1929, after service first as Government Chemist and Superintendent of Agriculture, Leeward Islands, and then as Director of Agriculture and Registrar of Co-operative Credit Societies, Mauritius.

The first matter demanding his attention was the internal re-organization of this Department, in order to ensure a greater measure of co-ordination in the activities of the various Divisions than had previously obtained, and to increase the extension work of the Field Division. His proposals to this end were accepted by Government and were brought into complete effect by the end of 1931. No sooner was this constructive work completed than financial depression which commenced in the following year necessitated considerable retrenchment of staff. This retrenchment Dr. Tempany successfully carried through with the minimum loss of efficiency in the general work of the Department and without materially affecting the new organization.

Prior to Dr. Tempany's arrival proposals for the establishment of a School of Agriculture for Malaya had been approved by Government. During the early part of his service it fell to Dr. Tempany's lot to give effect to these proposals which resulted in the opening of the School of Agriculture at Serdang in May, 1931. Dr. Tempany also paid particular attention to imparting an agricultural bias to the education given in the elementary vernacular schools, through the medium of school gardens; he further advocated the establishment of Farm Schools as a sequel to this training, with the object of disseminating through the peasantry a knowledge of modern improvements in agricultural practice. The first Farm School was opened in Malacca in August, 1935. Short courses on agricultural practice for village headmen were also instituted at the School of Agriculture, Malaya, with the same object.

In order further to assist the peasant proprietors, Dr. Tempany incorporated in recommendations to Government proposals for strengthening the staff of the Field Branch and for establishing numerous additional small Agricultural and Padi Test Stations where ocular demonstrations of improved methods are provided for local cultivators, and from which improved planting material can be distributed. There are now sixty-eight of these Stations and Plots scattered throughout the Peninsula.

In the course of his service Dr. Tempany was appointed by Government as Chairman of two Committees and one Conference, all of considerable importance.

The first of these was a Committee appointed in July 1930, to report on Rice Cultivation in Malaya. The result of the labours of this Committee is to be seen in considerable extension of the total acreage planted with rice over areas in which special systems of water control have been provided.

In December, 1930, Dr. Tempany was appointed Chairman of a Conference on the Malayan Pineapple Industry which resulted in legislation for the good of the industry and the provision of scientific assistance.

In April 1934, as a result of the low prices for copra and for oil palm products, a Vegetable Oils Committee was appointed with Dr. Tempany as Chairman. This Committee submitted a comprehensive study of the various factors influencing the situation. As a result of its recommendations relief was granted to these industries by Government in the form of reduction of quit rent and export duty. An organization of producers, in the form of the Vegetable Oils Section of the United Planting Association of Malaya, has also been an outcome of this Report. This Section is at present devoting particular attention to the possibility of establishing a special grade of copra on the market by means of a voluntary grading scheme.

Dr. Tempany also devoted considerable time and attention to the activities of the Rubber Research Institute of Malaya, of the Board of which he was President from April, 1929 to June 1934.

During Dr. Tempany's tenure of office the Head of this Department was made a member of the Federal Council of the Federated Malay States. Dr. Tempany himself was made a Commander of the Most Excellent Order of the British Empire in January, 1933.

The officers of this Department bid farewell to Dr. Tempany with regret and wish him the best of health and all success in his new appointment.

THE

Malayan Agricultural Journal.

JULY, 1936.

EDITORIAL.

Padi.

The importance of increasing yields of padi per acre has been rightly stressed on frequent occasions. In an article in a previous issue the results of experiments designed to determine the type or types of soil on which high yields of padi might be expected were described. To this end soils representative, as far as possible, of well-known padi areas were selected, and attempts were made to grow padi on all of them under exactly comparable conditions. The soils used in these experiments were of ten different types and were placed in unglazed earthenware containers. In the present number we publish an account of further experiments on growing padi in pots, by Mr. J. H. Dennett, Soils Chemist. The object of these experiments is principally to determine what treatment will raise yields above the so-called "bar", and subsequently to endeavour to ascertain, assuming that a suitable treatment is discovered, whether it is sound economically, and also to indicate the lines which future trials should take and where the more positive results are likely to be obtained. In certain countries, namely America, Japan and Italy, average yields of padi are recorded which are considerably higher than those usually obtained in Malaya, and it has been considered that the effect of daylight on growth is in some way responsible for this. In the countries mentioned the hours of day-light in the summer, as is well-known, are longer than those enjoyed in Malaya; thus, attempts, which are also described in Mr. Dennett's article, have been made to determine the effect of extra daylight on the growth of padi by illuminating the plants under experiment nightly from 10 p.m. to sunrise, until flowering commenced.

Copra.

In the April number of this Journal we published the first of a series of articles by Mr. F. C. Cooke, the Officer-in-Charge of Copra Investigations, on the construction of copra kilns suitable for owners of small areas of coconuts. The first article on experiments designed to assist small-holders to turn out good quality copra was published in the *Malayan Agricultural Journal* in the issue of July 1932. In the interim there has been a considerable fall in copra prices and, although there has been a definite recovery during the last twelve months, it is still desirable that unscorched dry white copra which will command the best market should be produced. This

can be achieved if kilns of certain design are employed. It has been found, however, that, owing to the fact that the majority of small-holders operate their kilns only once or twice a month, neither of the two kilns known as the "10" and "30 acre" kilns described in Part I of the present series of articles has aroused any considerable degree of interest, the "30 acre" kiln being considered only large enough for properties of less than 3 acres, and the "10 acre" too small.

A further article on kiln construction is published in this number, and the author points out that the system of naming kilns on a basis of maximum mature acreage and regular operation is unsatisfactory, and for these reasons has drawn up a code in which kiln sizes are based on acreage which is not directly specified but is indicated by a type number. This number indicates the area which the kiln could serve if used intermittently; ten times the type number shows the acreage for which the kiln is suitable if used continuously, and, multiplied by 100, it gives the approximate nut capacity of the kiln. Consequently the designation "10 acre kiln" is replaced by kiln Type 1 and "30 acre kiln" by kiln Type 3. Other types of kiln have also been allotted type numbers and three of these, namely 7, 8 and 15, are described in the article in detail, with particulars of the cost of their construction. The account of kiln Type 8 is contributed by Mr. C. W. S. Hartley, Agricultural Officer, Perak South.

Important constituents in the construction of a copra kiln are bricks, and it would seem to be greatly to the interest of the small-holder if he were able to make these himself from such material as is likely to be found on the spot or in the near neighbourhood. A note is therefore added as an appendix to Mr. Cooke's article, giving a brief account of the elements of brickmaking.

Original Articles.

FURTHER POT EXPERIMENTS WITH PADI

BY

J. H. DENNETT,

Soils Chemist.

For several years field work has been carried out by the Department of Agriculture with the object of increasing the yield of padi per unit area.

New strains of higher-yielding varieties have been isolated and bred and at the same time standard manurial trials have been laid down. In manurial trials it was always found possible to obtain increases of yield of some 30 per cent. on the medium, and even greater on the poorer soils, but with a crop of low value like padi only on the poorer soils is manuring found to be an economic proposition, and generally only where there are cheap local supplies of fertilizer. Further, it was found that sooner or later a "bar" was encountered above which normal manuring would not raise the yields.

In the prelude to his summary of padi manurial experiments for 1933-34 the Chief Research Officer made the following remarks:—

"The deductions drawn from previous experimental work were:—

(*a*) that whatever fertilizers gave results, phosphorus was found to be the essential element.

(*b*) that there appeared to be a bar above which yields could not be raised by any system of manuring with close planting. The bar apparently varied from 400 to 500 gantangs per acre depending on soil type and water conditions, and where, as is generally the case on the Stations, the normal yield approaches the hypothetical bar, manuring with fertilizers only gave uneconomic increases".*

In recent years more complex experiments have been tried with planting distances, varying cultural treatments such as green matter turned in early or late, or "chelluping"† either alone or combined with standard manurial experiments. The results were the same and no normal course appears to surmount the "bar". At the same time certain areas naturally gave yields above the bar and this led to the trials in pots with heavy uneconomic dressings of fertilizers.

In the *Malayan Agricultural Journal* for December, 1933 the results of trials of padi in irrigated pots on different types of soil were reported.

In those experiments the following soils were used:—

(1) Titi Serong (Perak).

(2) Selinsing (Perak).

(3) Pulau Gadong (Malacca).

* *Malayan Agricultural Journal*, Vol. XXII, December, 1934, page 583.

† Chelluping = dipping of the seedling into a thin manure paste before planting out in the field.

Table

Padi Pot Expe-

Soils	Dressed at rate of 4 tons green manure per acre						
	Raub Normal	Kuala Lumpur		Kuala Pilah	Kamunting		Lenggong
Line	Row 1	Row 1	Row 2	Row 1	Row 1	Row 2	Row 1
1—4	10 cwt. P_2O_5 30 cwt. K_2O	Nil	As row 1 & 10 cwt. SiO_2	10 cwt. P_2O_5	10 cwt. P_2O_5	10 cwt. P_2O_5 10 cwt. CaMg	10 cwt. P_2O_5
5—8	10 cwt. P_2O_5 7 cwt. K_2O	10 cwt. P_2O_5	As row 1 & 10 cwt. SiO_2	10 cwt. P_2O_5 10 cwt. CaMg	20 cwt. P_2O_5	40 cwt. P_2O_5 10 cwt. CaMg	20 cwt. P_2O_5
9—12	40 cwt. P_2O_5 7 cwt. K_2O	20 cwt. P_2O_5	As row 1 & 20 cwt. SiO_2	30 cwt. P_2O_5	40 cwt. P_2O_5	40 cwt. P_2O_5 40 cwt. CaMg	40 cwt. P_2O_5
13—16	40 cwt. P_2O_5 30 cwt. K_2O	40 cwt. P_2O_5	40 cwt. P_2O_5 40 cwt. SiO_2	30 cwt. P_2O_5 30 cwt. CaMg	60 cwt. P_2O_5	40 cwt. P_2O_5 40 cwt. CaMg	60 cwt. P_2O_5

Pots 4, 8, 12 and 16 in the case of Kuala Lumpur, Kamunting and Kuala Pilah treated in each case with peat as shewn in text.

10 cwt. of N. means 10 cwt. of ammonium sulphate or its equivalent, N. being used for brevity.

I.

riments 1935.

No green manure.						
Titi Serong	Malacca	Selinsing	Raub High-yielding	Penang		
Row 1	Row 1	Row 1	Row 1	Row 1	Row 2	
2 cwt. insoluble nitrogen (form. urea).	2 cwt. insoluble nitrogen (form. urea). 30 cwt. P_2O_5	2 cwt. insoluble nitrogen (humic acid)	10 cwt. insoluble nitrogen (form. urea). 10 cwt. P_2O_5	10 cwt. insoluble nitrogen (horn)	As row 1 + 10 cwt. Silica.	Second row of Kuala Pilah, Titi Serong, Malacca, Selinsing, Raub High-yielding and Lenggong as first row, but artificially lighted from 10 p.m. until sunrise.
30 cwt. - do. -	30 cwt. - do. -	20 cwt. - do. -	40 cwt. - do. - 10 cwt. P_2O_5	40 cwt. - do. -		
2 cwt. soluble nitrogen (Am_2SO_4)	2 cwt. soluble nitrogen (Am_2SO_4) 30 cwt. P_2O_5	30 cwt. Am_2SO_4 30 cwt. P_2O_5 22 cwt. K_2O	10 cwt. - do. - 40 cwt. P_2O_5	10 cwt. - do. - 10 cwt. CaMg		
20 cwt. - do. -	30 cwt. - do. - 30 cwt. P_2O_5	30 cwt. Am_2SO_4 30 cwt. P_2O_5 22 cwt. K_2O 30 cwt. CaMg	40 cwt. - do. - 40 cwt. P_2O_5	10 cwt. - do. - 40 cwt. CaMg		

10 cwt. P_2O_5 means 10 cwt. superphosphate.
10 cwt. K_2O means 10 cwt. potassium sulphate.
10 cwt. CaMg means 10 cwt. of a mixture of calcium carbonate, calcium sulphate, magnesium carbonate, and magnesium sulphate in molecular proportions.

(4) Kamunting (Perak) (reslimed mining land).
(5) Kuala Lumpur (ordinary typical Hill Quartzite soil).
(6) Lenggong (Perak) high-yielding area.
(7) Kuala Pilah (typical granite padi soil).

At the end of the 1933 season the cages and pots were further extended to make up 32 pots instead of 30 for each soil type, and the following additions were made:—

(8) Raub (Pahang) high-yielding area.
(9) Raub (Pahang) normal-yielding area.
(10) Penang Island (Balik Pulau) the highest-yielding padi soil in Malaya and showing itself richest by chemical analysis.

1934 Season.

From the results obtained in the 1933 season already reported on, it appeared possible that the following might be important, (1) silica, (2) calcium and magnesium, (3) heavy dressings of phosphate and/or nitrogen.

The proposals were based on the fact that in the previous season (1) there was an increase in silica content of the ash with yield, (2) there appeared to be a relationship between the combined calcium and magnesium and yield, (3) the high-yielding soils were definitely richer in nitrogen and phosphates.

Small quantities of minor elements were added to certain soils.

In order that results should be available by the end of the year planting was carried out in March. Unfortunately the padi was considerably attacked by stem borers, and, from information supplied by the Government Entomologist, it would appear that this may be expected if planting is made earlier than the end of May (in Selangor).

The attack vitiated most of the results and the only definite conclusion was that the padi receiving dressings up to 10 cwt. of ammonium sulphate and/or superphosphate shewed remarkably early growth. In nine out of thirteen cases silica added in the form of 10 cwt. of sodium silicate shewed increases of growth over similar treatments without silica.

Mixtures of calcium and magnesium in the form of carbonates and sulphates also shewed increases.

1935 Season.

On the advice of the Government Entomologist, in order to avoid, if possible, the incidence of borer attack, the nursery in 1935 was prepared considerably later and the padi was not planted out until the last week in May. Less than one half per cent. of the plants were attacked in consequence.

Treatments.

From laboratory observations made on a number of padi soils over a period of some two years it was found that there were considerable losses of nitrogen in the form of ammonium sulphate in the irrigation water and to a smaller degree

of phosphate. It is possible that no such loss occurs under growing padi, but these losses suggested a relationship with availability.

In 1934 the writer discussed the question of ammonium losses with the scientific staff of the Imperial Chemical Industries Research Station at Jealott's Hill. The problem was (*a*) whether lack of response to nitrogen above a certain point was due to most of the nitrogen disappearing in the drainage water as ammonium sulphate or (*b*) could yield be increased by the addition of ammonium sulphate or nitrogen in any form to bring the nitrogen content of an average soil up to that of the higher-yielding soils like those of Penang and Lenggong.* To overcome the loss of ammonium sulphate it was decided to add nitrogen in insoluble forms and for this purpose the writer is indebted to Mr. H. J. Page, Head of the Research Station at Jealott's Hill, for samples of the following:—

		per cent.
Urea formaldehyde powder	N_2	23.1
Ground horn		18.1
Humic acid		4.5
Nitrated coal		9.2

At the same time it was decided that dressings of phosphate, potash and calcium or magnesium, sufficiently heavy to be commensurate with the total content of an average soil, should be tried out. This involved dressings up to 60 cwt. of superphosphate, 40 cwt. of combined calcium and magnesium salts, 22 cwt. of potash and 30 cwt. of ammonium sulphate or its equivalent nitrogen in an insoluble form.

It was hardly to be expected that any of these dressings were likely to be economic but high hopes were entertained that this would prove to be the solution of the "bar" to higher yield encountered at about 500 to 600 gantangs. The extent to which these hopes were justified will be shown below.

In view of the differences in yield obtainable in Malaya and in America, Japan or Italy it was decided also to determine the effect of extra daylight on growth of padi in Malaya.† For this purpose an additional sixteen pots of each of the following soils were shielded from the rest by a wall. Twelve shaded lights, six with ordinary 75 watt bulbs and six with 75 watt daylight blue bulbs, were placed at a height of 5 feet 6 inches over the following pots of soils:

(1) Kuala Pilah
(2) Titi Serong
(3) Malacca
(4) Selinsing
(5) Raub
(6) Lenggong.

These lights were on from 10 p.m. until sunrise.

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* In this connexion it should be remembered that in Java with padi growing on terraces it is possible to remove the water and add manure periodically during the growing season.

† This has been investigated in Japan by Yutaka Fuke, *vide* Journal of Imperial Expt. Station (Tokyo), Vol. I, No. 4, March, 1931.

Peat.

In order to get more exact observations on the effect of peat, than were available, raw peat from Kuala Selangor District, having a nitrogen content of 1.02 per cent. (on dry) and dry matter content of 12 per cent. and pH 4.5 to 5.0, was added to every fourth pot of the following soils:

Both rows of	Lenggong Kuala Pilah Kuala Lumpur Kamunting	Pot 4 500 gms. Pot 8 1,000 ,, Pot 12 1,500 ,, Pot 16 2,000 ,,

The exact detailed and rather complicated lay-out is given in the table attached.

Discussion of Treatments.

Raub Poor.

1st row only. Testing the effect of high and medium dressings of phosphate against high and medium potash. Nitrogen supplied the same throughout as green manure and neglected as manurial factor (poor to medium soils).

Kuala Lumpur.

1st row Testing effect of medium to heavy phosphate dressings without potash, with nitrogen supplied as green manure throughout and neglected. Peat in every fourth pot (very poor non-padi soil).

2nd row. Testing effect of addition of varying quantities of sodium silicate to the phosphate treatments of 1st row. Nitrogen as above. Peat in every fourth pot.

Kuala Pilah.

1st row. Testing effect of medium and heavy dressings of phosphate with calcium and magnesium salts. Nitrogen treatment as above (poor soil). Peat in every fourth pot.

2nd row. As first row with artificial lighting.

Kamunting.

1st row. Testing the effect of 10 to 60 cwt. of phosphate on a rather better soil than Kuala Lumpur. Nitrogen as above. Peat in every fourth pot.

2nd row. As Kuala Pilah 1st row above.

Lenggong.

1st row. Testing the effect of 10 to 60 cwt. of superphosphate on a high-yielding soil. Peat in every fourth pot. Nitrogen as above.

2nd row. As first row with artificial lighting.

Titi Serong.

1st row. Confirming effect of normal (2 cwt.) and heavy (30 cwt.) dressings of ammonium sulphate against similar dressings of insoluble nitrogen in the form of form: urea (good soil).

2nd row. As first row with artificial lighting.

Malacca.

1st row. As for Titi Serong but with the addition of 30 cwt. of superphosphate throughout (fairish soil).

2nd row. As first row with artificial lighting.

Selinsing.

1st row. First four pots have light dressing of insoluble nitrogen, and next four heavy dressing to compare with Titi Serong above, the form: urea being replaced by humic acid. Third four pots have a complete heavy dressing of N.P.K., and last four have similar dressing with the addition of calcium and magnesium (good soil).

2nd row. As first row with artificial lighting.

Raub Good.

1st row. Testing combinations of medium and heavy dressings of insoluble nitrogen (form: urea) and medium and heavy dressings of superphosphate (high-yielding soil).

2nd row. As first row with artificial lighting.

Penang.

1st row. Comparison of medium and heavy dressings of insoluble nitrogen in the form of horn and testing of medium dressings (10 cwt.) (of horn) against medium and heavy dressings of calcium and magnesium.

2nd row. As first row with the addition of 10 cwt. of sodium silicate.

Growth.

As in the previous two seasons, practically no supplying was necessary and the plants made rapid progress from the start. Those which were to be submitted to artificial light were allowed three weeks to become established, before treatment.

Within two or three weeks it became apparent that with some treatments padi was making phenomenal growth. This applied particularly to Raub (high-yielding) Penang (high-yielding), Raub (normal-yielding) and Kuala Pilah (poor-yielding).

In the earliest stages Raub (normal) treated with phosphate and potash only, had the best appearance but by the end of two months the lack of nitrogen was showing in the yellowish colour of the leaves. Normal dressings of both nitrogen and phosphate have frequently resulted in abnormally good growth which is not

apparent later but this phenomenal growth seems to have been maintained generally in these experiments.

Malacca soil treated with high and low soluble and insoluble nitrogen gave interesting growth results. Those treated with 2 cwt. ammonium sulphate shewed excellent early growth, while those treated with 30 cwt. seemed to be suffering from acute poisoning from which the plants nearly died. Those treated with insoluble nitrogen shewed excellent early growth with little difference between the heavy and light dressings. Plants treated with the heavy dressings of ammonium sulphate managed to recover, however, and finally shewed abnormally good growth compared with the normal ammonium sulphate dressing.

Similar results were obtained with the Selinsing soil which was given a heavy dressing of ammonium sulphate.

In the series with artificial daylight, a different effect was observed for both these soils. In this case the heavy dressing of ammonium sulphate gave excellent growth from the beginning.

In general, at the end of two months, all nitrogen-dressed soils had a deeper green padi than those not so treated, with the exception of those treated with peat, where the padi generally appeared to be suffering from chlorosis.

Artificial Light.

For the first two or three weeks after artificial light treatment was commenced there was little to choose between pots undergoing such treatment and those with normal daylight. Later, plants with normal light were taller while the artificially lighted ones were sturdier. As the season progressed this became more marked until there was at least a foot difference in the average height while the number of tillers produced was much the same.

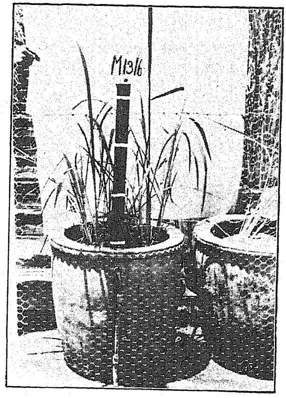
At the end of four months the normally lighted pots were in flower and had become so unusually tall that it was necessary to raise the roof of the cage by some two feet, their height being over 7 feet. At the end of this period there was no sign of flowering in the artificially lighted cage and the height was about 5 feet, but the number of tillers shewed an increase over the normally lighted. At the end of five months the height of the artificially lighted padi was sufficient to reach the source of illumination in places, thus causing one corner to be darkened. Padi in this corner rapidly came into flower. At the beginning of November this artificial lighting was stopped and all padi started to flower.

The Yields.

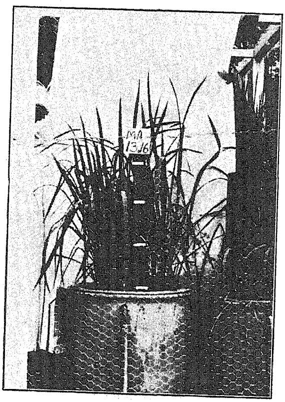
In the 1933 experiments it was found that yields could be converted into gantangs per acre by multiplying the yield (in pounds) of four pots (one treatment) by the inverse of the area in acres of these four pots. This gave the yield per acre in pounds. Division by 5.5 gave gantangs per acre.* The figures so obtained approximated closely to those taken in the field for similar soils. Yields taken in

* Measurements over all the pots shewed that the average figure (from which variation was small) for density of grain was about 5.5.

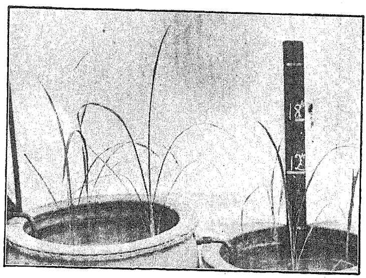
1935
AT TWO MONTHS
MALACCA
30 cwt. Form: Urea



1935
AT TWO MONTHS
MALACCA
30 cwt. Am. Sulphate

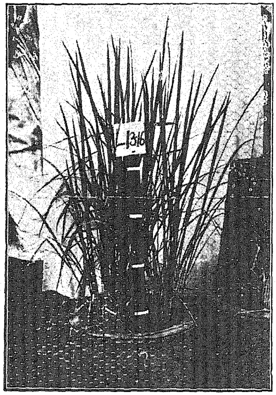


1935
AT TWO MONTHS
MALACCA
Artificial lighting
30 cwt. Am. Sulphate

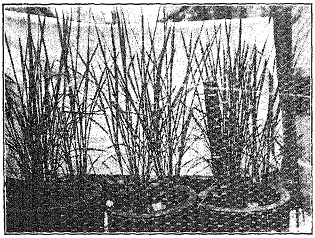


1933
AT TWO MONTHS
MALACCA
No treatment

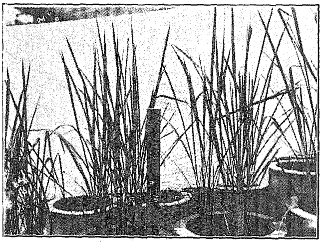
1935
AT TWO MONTHS
LENGGONG
4 tons Green Manure, 10 cwt. P_2O_5



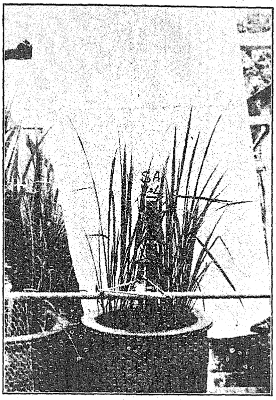
1935
AT TWO MONTHS
LENGGONG
4 tons Green Manure, 60 cwt. P_2O_5



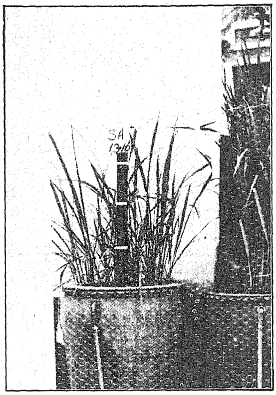
1934
AT TWO MONTHS
LENGGONG
1½ cwt. P_2O_5, 20 lbs. Copper Sulphate, 1 cwt. Am. Sulphate, 20 lbs. Manganese Sulphate.



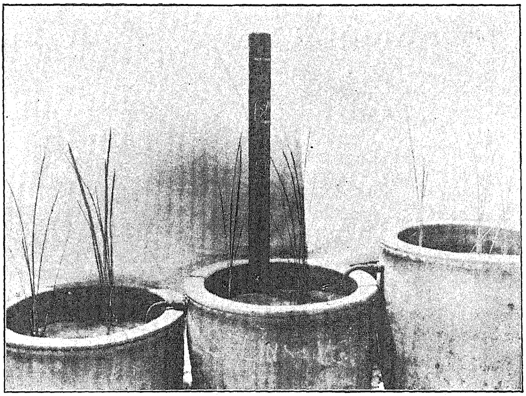
1933
AT TWO MONTHS
LENGGONG
No treatment.



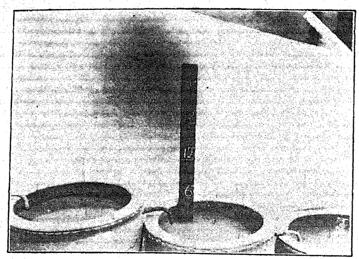
1935
AT TWO MONTHS
SELINSING
ARTIFICIALLY LIGHTED
2 cwt. Humic Acid.



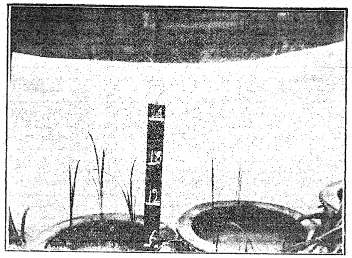
1935
AT TWO MONTHS
SELINSING
30 cwt. P_2O_5, 30 cwt. Am. Sulp.
22 cwt. Potash : 30 cwt. Ca.Mg.



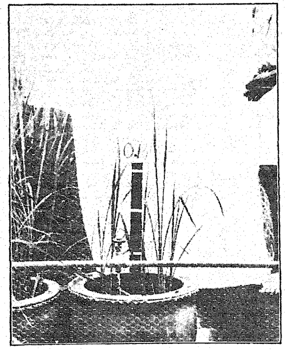
1933
AT TWO MONTHS.
SELINSING
No treatment.



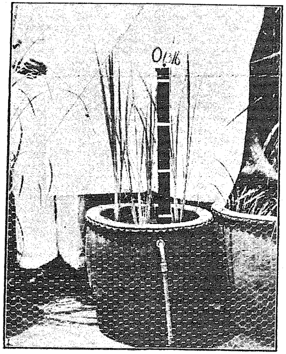
1933
At two months
KUALA LUMPUR
No treatment.



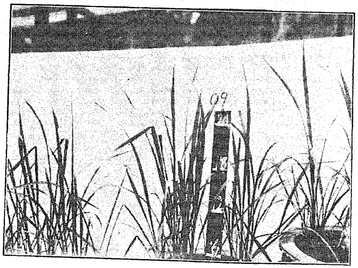
1934
At two months
KUALA LUMPUR
4 tons Green Manure.



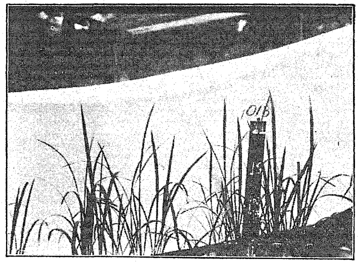
1935
At two months
KUALA LUMPUR
4 tons Green Manure.



1935
At two months
KUALA LUMPUR
4 tons Green Manure, 40 cwt. P_2O_5



1934
At two months
KUALA LUMPUR
3 cwt. P_2O_5, 2 cwt. Am. Sulphate.



1934
At two months
KUALA LUMPUR
3 cwt. P_2O_5, 2 cwt. Am. Sulphate, 10 cwt. Ca.Mg.

Table II Yields

Factor														
	All Treated with 4 tons Green Manure per acre.													
	Raub (Normal)					Kamunting								
	10 cwt. Super 30 cwt. Potash	10 cwt. Super 7 cwt. Potash	40 cwt. Super 7 cwt. Potash	40 cwt. Super 30 cwt. Potash	1933	10 cwt. Super	20 cwt. Super	40 cwt. Super	60 cwt. Super	10 cwt. Super 10 cwt. CaMg	40 cwt. Super 10 cwt. CaMg	10 cwt. Super 40 cwt. CaMg	40 cwt. Super 40 cwt. CaMg	1933
Mean tillers at 2 months	10.0	10.4	10.4	10.8	—	8.5	8.0	9.3	9.9	10.1	8.4	6.5	8.3	5.77
Mean tillers at harvest	13.07	8.34	8.16	7.17	—	8.44	7.34	6.47	6.69	9.33	8.9	9.45	9.69	3.7
Mean height at 2 months	51″	54″	50″	48″	—	44″	43″	41″	40″	48″	44″	44″	42″	33″
Mean height at harvest	61″	66″	54″	55″	—	55″	61″	48″	52″	62″	55″	56″	51″	38″
Mean spikelets per tiller	4.1	10.5	9.1	12.4	—	8.7	9.0	10.8	9.8	8.2	6.5	5.0	6.6	2.69
Mean weight in grams of grain per plant (a)	13.5	25.1	25.4	26.4	—	27.2	22.7	19.1	17.8	30.0	17.2	17.4	12.2	
(b) peat	—	—	—	—	—	5.3	4.7	7.0	6.5	5.3	8.3	5.5	11.7	
Mean calculated yield in gantangs per acre (a)	**560**	**1055**	**1050**	**1090**	Figure for 1933 pots not available—field estimate 350.	**1130**	**940**	**745**	**740**	**1250**	**710**	**725**	**510**	**365**
(b) peat	—	—	—	—		**718**	**417**	**553**	**832**	**220**	**345**	**232**	**485**	
Ratio mean grain/straw	0.34	0.72	0.83	0.88		0.90	0.82	0.73	0.80	0.80	0.99	0.92	0.70	
Ratio mean grain/stalk	0.87	1.35	1.60	1.92		1.86	1.83	1.40	1.63	1.85	2.39	2.04	1.93	
Percentage increase cf. 1933	60	201	200	211		213	158	105	104	243	96	98	40	
Significant difference between treatments (gantangs) (a) / (b) peat	450					270				376				
Remarks on (a) Growth	Poor	Poor	Poor	Poor		Poor	Medium	Poor	Poor	Medium	Medium	Medium	Medium	
(b) Stalks	Thin	Thin	Thick	Thick		Large and thin	Large and thin	Large and thin	Large and thin	Thin	Thin	Thick	Thin	
Percentage of empty glumes (a)	12.7	8.11	4.57	1.44		7.47	2.78	6.33	4.92	2.9	2.76	3.48	3.75	
(b) peat	—	—	—	—		9.65	2.77	3.98	0.85	1.36	3.66	5.37	5.42	

Note :—There was no manurial treatment in 1933.

Table II (*Continued*)

Factor		All Treated with 4 tons Green Manure per acre.									
		LENGGONG					KUALA PILAH				
		10 cwt. Super	20 cwt. Super	40 cwt. Super	60 cwt. Super	1933	10 cwt. Super	10 cwt. Super 10 cwt. CaMg	30 cwt. Super	30 cwt. Super 30 cwt. CaMg	1933
Mean tillers at 2 months		8.9	8.4	9.0	8.4	5.57	11.3	11.4	9.7	11.0	1.12
Mean tillers at harvest		10.8	8.66	9.9	7.1	4.84	12.6	12.1	10.05	11.6	—
Mean height at 2 months		52″	53″	46″	46″	39″	49″	46″	50″	44″	37″
Mean height at harvest		72″	70″	64″	66″	52″	61″	64″	58″	68″	—
Mean spikelets per tiller		8.2	8.0	7.8	8.3	4.89	8.4	9.2	7.7	6.5	5.23
Mean weight in grams of grain per plant	(a)	56.7	44.7	28.9	47.2		49.1	36.7	15.5	31.7	
	(b) peat	35.0	30.0	35.0	24.0		17.3	10.0	13.3	20.0	
Mean calculated yield in gantangs per acre	(a)	**2330**	**1360**	**1725**	**1840**	**960**	**2020**	**1510**	**645**	**1320**	**220**
	(b) peat	**1650**	**1250**	**1450**	**986**		**720**	**555**	**555**	**830**	
Ratio mean grain/straw		1.01	1.01	0.66	1.27		0.63	0.54	0.30	0.44	
Ratio mean grain/stalk		1.58	2.84	1.00	3.37		1.71	2.16	2.01	2.21	
Percentage increase cf. 1933		143	94	80	92		818	586	193	500	
Significant difference between treatments (gantangs)	(a)		650					390			
	(b) peat		540					337			
Remarks on	(a) Growth	Good	Medium	Medium	Good		Medium	Medium	Medium	Medium	
	(b) Stalks	Thick	Thin	Thick	Thick		Thin	Thin	Thin	Thin	
Percentage of empty glumes	(a)	2.32	0.76	4.95	0.58		6.18	1.98	4.28	1.62	
	(b) peat	7.74	6.08	8.75	8.52		9.8	2.86	5.5	1.7	

Note :—There was no manurial treatment in 1933.

Table II (*Continued*)

Factor	Treated with 4 tons Green Manure per acre. Kuala Lumpur (Hill Quartzite)									No Green Manure. Raub (High-yielding)				
	Nil	10 cwt. Super	20 cwt. Super	40 cwt. Super	10 cwt. Silica	10 cwt. Super 10 cwt. Silica	20 cwt. Super 10 cwt. Silica	40 cwt. Super 10 cwt. Silica	1933	10 cwt. Super 10 cwt. Form : Urea	10 cwt. Super 40 cwt. Form : Urea	40 cwt. Super 10 cwt. Form : Urea	40 cwt. Super 40 cwt. Form : Urea	1933
Mean tillers at 2 months	2.1	8.0	8.6	7.0	2.4	8.5	7.89	8.46	—	10.7	11.8	10.2	12.2	
Mean tillers at harvest	2.78	6.33	5.79	6.12	3.45	7.33	7.33	5.78	—	8.76	10.72	8.75	11.1	
Mean height at 2 months	38″	43″	39″	38″	40″	45″	44″	38″	5″	55″	59″	52″	52″	
Mean height at harvest	49″	51″	47″	48″	81″	53″	52″	49″	died	74″	87″	75″	72″	
Mean spikelets per tiller	—	5.0	5.3	2.1	—	7.6	6.5	6.4	—	10.2	10.1	10.1	10.2	
Mean weight in grams of grain per plant (a)	—	6.2	8.4	3.1	—	13.5	7.8	4.4	—	31.4	46.7	28.3	32.1	
(b) peat	—	2.9	3.7		—	2.2	2.3	—						
Mean calculated yield in gantangs per acre (a)	Nil	260	350	155	Nil	560	325	185	Nil	1300	1925	1170	1330	Field estimate 1,000 gantangs
(b) peat	Nil	137	150	Nil	Nil	90	90	Nil						
Ratio mean grain/straw	—	0.32	0.41	0.22	—	0.48	0.42	0.24		0.65	0.80	0.72	0.86	
Ratio mean grain/stalk	—	0.88	0.84	0.70	—	0.98	0.94	0.30		1.33	1.18	1.47	1.10	
Percentage increase cf. 1933	—	—	—	—	—	—	—	—		30	92	17	33	
Significant difference between treatments (gantangs) (a)		474				510					320			
(b) peat														
Remarks on (a) Growth	Very poor	Poor	Poor	Poor	Good	Medium	Medium	Medium		Good	Very good	Good	Best	
(b) Stalks	Thin	Thin	Thin	Thin	Thick	Thick	Thick	Thick		Thin	Thick	Thick	Very thick	
Percentage of empty glumes (a)	—	4.28	16.3	9.4	—	8.32	5.7	5.12		1.7	5.92	4.27	1.91	
(b) peat	17.3	2.6	2.82	3.86	—	—	—	—						

Note :—There was no manurial treatment in 1933.

Table II (*Continued*)

Factor		Penang: 10 cwt. Ground Horn *	Penang: 40 cwt. Ground Horn *	Penang: 10 cwt. Ground Horn * 10 cwt. CaMg	Penang: 10 cwt. Ground Horn * 40 cwt. CaMg	Penang: 10 cwt. Ground Horn * 10 cwt. Silicate	Penang: 40 cwt. Ground Horn * 10 cwt. Silicate	Penang: 10 cwt. Ground Horn * 10 cwt. CaMg 10 cwt. Silicate	Penang: 10 cwt. Ground Horn * 40 cwt. CaMg 10 cwt. Silicate	Penang: 1933	Malacca: 2 cwt. Form: Urea. 30 cwt. Super *	Malacca: 30 cwt. Form: Urea. 30 cwt. Super *	Malacca: 2 cwt. Ammonium Sulphate 30 cwt. Super	Malacca: 30 cwt. Ammonium Sulphate 30 cwt. Super	Malacca: 1933
		No Green Manurial Treatment													
Mean tillers at 2 months		10.6	12.1	11.1	12.6	13.1	12.3	12.7	11.7		5.25	12.68	5.92	3.58	1.98
Mean tillers at harvest		10.75	12.75	11.75	11.65	11.75	16.25	11.9	16.3		4.42	18.6	4.08	8.77	2.49
Mean height at 2 months		56″	55″	54″	53″	51″	57″	61″	53″		41″	51″	41″	37″	30″
Mean height at harvest		78″	80″	79″	73″	80″	85″	81″	76″		50″	69″	46″	49″	39″
Mean spikelets per tiller		10.7	11.3	10.5	11.9	16.7	9.6	9.7	7.7		10.1	10.0	10.0	9.1	3.84
Mean weight in grams of grain per plant	(a)	56.1	62.1	41.4	51.5	56.1	62.1	41.4	51.5		13.3	58.0	9.5	19.7	
	(b) peat	—	—	—	—	—	—	—	—		—	—	—	—	
Mean calculated yield in gantangs per acre	(a)	**2385**	**2565**	**1740**	**2120**	**2110**	**2540**	**1715**	**2140**	**1000**	**550**	**2430**	**390**	**817**	**377**
	(b) peat														
Ratio mean grain/straw		1.00	1.12	0.75	1.02	0.78	0.99	0.72	0.70	Field estimate, plots not available	0.95	0.97	0.78	0.75	
Ratio mean grain/stalk		1.02	1.18	1.10	1.58	1.41	1.31	1.16	1.85		2.29	0.93	1.48	0.91	
Percentage increase cf. 1933		138	156	74	112	111	154	71	114		46	545	3.5	117	
Significant difference between treatments (gantangs)	(a)	1440				1240					138				
	(b) peat														
Remarks on	(a) Growth	Very good	Very good	Good	Very good	Very good	Very good	Very good	Very good		Fairly good	Very good	Very good	Very good	
	(b) Stalks	Very thick	Very thick	Thick	Thick	Thick	Very thick	Very thick	Very thick		Thin	Thick	Thin	Thick	
Percentage of empty glumes	(a)	2.30	4.67	0.73	5.58	1.47	1.98	0.75	1.2		6.34	3.23	6.22	1.63	
	(b) peat	—	—	—	—	—	—	—	—						

* It must be remembered that with these insoluble nitrogen compounds 10 cwt. etc. means a quantity containing the same amount of nitrogen as 10 cwt. etc. of ammonium sulphate.

Note:—There was no manurial treatment in 1933.

Table II (*Continued*)

Factor		No Green Manurial Treatment									
		TITI SERONG					SELINSING				
		2 cwt. Form : Urea	30 cwt. Form : Urea	2 cwt. Ammonium Sulphate	30 cwt. Ammonium Sulphate	1933	2 cwt. Humic Acid *	20 cwt. Humic Acid *	3 cwt. Am. Sulph. 30 cwt. Super 22 cwt. Potash	3 cwt. Am. Sulph. 30 cwt. Super 22 cwt. Potash 30 cwt. CaMg	1933
Mean tillers at 2 months		5.72	9.59	6.34	5.51	2.87	5.67	7.0	6.67	12.85	1.27
Mean tillers at harvest		5.84	12.0	6.25	8.5	2.73	6.08	5.92	9.9	16.5	2.75
Mean height at 2 months		44″	47″	45″	45″	33″	46″	42″	48″	51″	16″
Mean height at harvest		52″	72″	57″	62″	41″	57″	69″	64″	74″	49″
Mean spikelets per tiller		12.5	10.2	9.1	10.4	3.58	11.5	10.8	10.8	8.4	4.34
Mean weight in grams of grain per plant	(a)	23.9	51.7	16.7	43.3		25.5	17.4	38.8	58.6	
	(b) peat	—	—	—	—		—	—	—	—	
Mean calculated yield in gantangs per acre	(a)	**995**	**2170**	**695**	**1800**	**403**	**1060**	**720**	**1610**	**2415**	**527**
	(b) peat										
Ratio mean grain/straw		1.15	1.04	0.78	1.23		0.89	0.80	1.05	1.12	
Ratio mean grain/stalk		2.07	1.69	1.90	1.81		2.31	2.32	1.86	2.74	
Percentage increase cf. 1933		147	435	72	350		101	37	206	360	
Significant difference between treatments (gantangs)	(a)		810					1120			
	(b) peat										
Remarks on	(a) Growth	Fairly good	Very good and	Poor	Best		Medium	Medium	Good	Best	
	(b) Stalks	thick	Large thick	Thin	Very thick		Thick	Thick	Thick	Thick	
Percentage of empty glumes	(a) (b) peat	7.22	3.23	8.98	3.9		2.5	2.03	1.63	2.8	

* It must be remembered that with these insoluble nitrogen compounds 10 cwt. etc. means a quantity containing the same amount of nitrogen as 10 cwt. etc. of ammonium sulphate.

Note :—There was no manurial treatment in 1933.

1933 are taken as standards with which to compare the yields obtained this year. The figures for the yields are given in gantangs per acre for convenience of visualization of the type of yield being obtained and they are also given as a percentage increase or decrease compared with 1933.

The results obtained are very striking; full details of these are given in Table II. For convenience, details of the 1933 figures are added. Table II only applies to those pots with normal lighting. In addition, this year the table shews the percentage by weight of empty glumes. It is interesting to note that in general the poorer the yield the larger is such percentage.

It seems advisable to discuss the effect of different fertilizers under their different heads, but there appear to be certain general comments to make.

(i) The effect of peat is greatly to depress the yield even when the addition of raw peat amounts to only 2 per cent. of the top six inches of soil. With gradually increasing amounts up to 8 per cent. the effect is increasingly marked.

(ii) The response to *increasing* dressings of phosphate alone from 10 to 60 cwt. superphosphate has been very little, but for 10 cwt. only has been considerable.

(iii) The response to heavy dressings of nitrogen both soluble and insoluble has been very great.

A. The Phosphate Effect.

(1) *Alone.*

Taking firstly the rows to which phosphate only had been added, *i.e.* Lenggong Row 1, Kamunting Row 1 and Kuala Lumpur Row 1, it will be seen that the significant differences between any two treatments are 650, 270 and 474 gantangs per acre respectively, so that there is no significant difference between 10, 20, 40 and 60 cwt. of P_2O_5 as far as Lenggong is concerned (though there is a fall with increased P_2O_5), and that in the case of Kamunting there is a gradual drop in yield with increasing amounts of superphosphate so that 10 cwt. is actually just significantly better than 60 cwt. It must be noted, however, that in the case of Lenggong the *increase* in yield compared with the control year of 1933 varies from a minimum of 80 per cent. to a maximum of 148 per cent.; such figures seem likely to be due to heavy dressings of phosphate. In the case of Kamunting the increases are between 40 and 240 per cent.

In the case of Kuala Lumpur (Hill Quartzite) there is an increase in yield from 10 to 20 cwt. of superphosphate though this is not significant, but at 40 cwt. the yield again drops away. The percentage increase compared with the control year cannot be calculated, as no yield was obtained in 1933. It should be noted that three seasons' treatment under anaerobic conditions only does not seem to have made any marked improvement in the first four pots of Kuala Lumpur soil, these pots shewing poor growth and no yield.

(2) *With Silica.*

The only trial made with P_2O_5 and silica was on Kuala Lumpur soil. In this case there was the same falling off in yields between 10, 20 and 40 cwt. super-

phosphate, (the silica being the same throughout 10 cwt. "water glass") but the yield was double in the case of 10 cwt. superphosphate and silica and the same in the case of 20 cwt. compared with phosphate only. This is further discussed under silica.

(3) *With Potash.*

Here again where 10 and 40 cwt. of superphosphate were each tried with 7 and 30 cwt. of potash, there is little to choose between 10 and 40 cwt. as far as the phosphate is concerned.

(4) *With Calcium and Magnesium.*

For this purpose the rather poor Kuala Pilah and Kamunting soils were used, and 10 and 30 cwt. of superphosphate were compared with and without corresponding amounts of calcium and magnesium. The results obtained were remarkable in the case of Kuala Pilah as the addition of 10 cwt. superphosphate alone gave an increase of 810 per cent. over the control year figure of 220 gantangs, the actual figure being 2,020 gantangs. Again, the heavier dressing of phosphate alone had a depressing effect and it would appear that the effect of the phosphate was the same in combination with calcium and magnesium.

In the case of Kamunting the comparison in each case was between combinations of 10 and 40 cwt. calcium and magnesium mixtures and superphosphate. Again the depressing effect of the heavier dressing of phosphate and the excellent effect of 10 cwt. is to be noted, the yield being 1,300 gantangs or 210 per cent. increase for the latter case.

(5) *With Insoluble Nitrogen.*

In comparing 10 and 40 cwt. of superphosphate in combination with 10 and 40 cwt. of insoluble nitrogen (with Raub good soil) much the same type of result is obtained, the comparative dressings of 40 cwt. nitrogen with 10 and 40 cwt. superphosphate being identical, while the 10 cwt. nitrogen with similar phosphate shews a rather slighter effect for the heavier dressing. Owing to the phosphate dressing being the same throughout, in the case of Malacca soil no consideration can be taken of the P_2O_5 which was added as a dressing for the comparison of different nitrogenous manures. From observations on phosphates made above it would appear that Malacca might have shewn even better results for nitrogen had the superphosphate been reduced to about 10 cwt.

To sum up, it appears that increases far beyond the "bar" can be obtained with phosphates. The optimum dressing appears to be of the order of 10 cwt. superphosphate. This does not imply that the maximum phosphate dressing is 10 cwt. but it is possibly the order of the optimum for an acid manure (see humic acid below).

B. Nitrogen.

By far the most important results obtained this year have been in connexion with nitrogen, and although increased vegetative growth is nearly always observed with a nitrogenous manure, yet no result has so far been obtained above the "bar" in this country. The results here recorded, therefore, are of unusual interest and importance.

(1) *Insoluble Nitrogen.*

(*a*) Ground Horn (18 per cent. N.).

The first two lots of Penang soil pots were treated with 10 and 40 cwt. of insoluble nitrogen in the above form. The response was excellent, the yields being 2,385 and 2,565 gantangs, increases of 138 and 156 per cent. respectively. As the standard error was large there is no significant difference between these two results.

(*b*) Formaldehyde Urea (23 per cent. N.) (Referred to in text as form: urea).

This was applied to two lots of Titi Serong soil at the rate of 2 and 30 cwt. and the yields were 995 and 2,170 gantangs shewing increases of 145 per cent. and 435 per cent. The difference is significant but yields in the second case are not commensurate with the extra nitrogen added.

(*c*) Humic Acid (4.5 per cent. N.).

This was applied to two lots of Selinsing soil at the rate of 2 cwt. and 20 cwt. It should be remembered that these applications at "2 cwt. etc." are quantities containing the same amount of nitrogen as 2 cwt. of the standard ammonium sulphate, so that a fairly large quantity of humic acid was involved, approximately five times the weight of ammonium sulphate. The results obtained from 2 and 20 cwt. were 1,060 and 720 gantangs—increases of 100 and 37 per cent. respectively. The result, though differing from horn and form: urea, is not altogether unexpected as the large amount of acid added in the second case may have materially affected the soil bases, but here again the effect of nitrogen in an insoluble form is still apparent.

(2) *Insoluble Nitrogen in Combination.*

(*a*) Form: urea + Superphosphate.

This combination was tried out on the Raub high-yielding soil, 10 cwt. of form: urea combined with 10 and 40 of superphosphate and 40 cwt. of form: urea combined with 10 and 40 of superphosphate.

The results were in conformity with those discussed above. The 10 and 10 combination gave 1,300 gantangs, the 10 P and 40 N gave 1,925 gantangs, the 10 N with 40 P dropping to 1,170, again illustrating the rather depressing effect of excessive acid phosphate, the 40 and 40 mixture was slightly better at 1,330 gantangs. In terms of percentage increase the figures give 30, 92, 17 and 33 respectively. The notable effect of insoluble nitrogen is not actually so marked as with nitrogen alone.

In the case of Malacca soil the phosphate dressing was kept at 30 cwt. throughout, a figure which, from the general results obtained this season, appears to be too high and it is, therefore, probable that more striking results would be obtained with less phosphate. The yields for 2 and 30 cwt. of form: urea were 550 and 2,430 respectively showing increases of 46 and 545 per cent. It appears that the heavier nitrogen probably counterbalanced the too heavy phosphate to some extent, a conclusion to be derived also from the Raub good soil.

(*b*) Ground Horn and Silica (10 cwt. Sodium Silicate).

For this purpose the second row of Penang soil was used, but only in com-

bination with 10 cwt. of ground horn did it give a positive result, when the figure of 2,110 gantangs was obtained. With 40 cwt. of horn it gave the same as horn alone and in combination with horn, calcium and magnesium it gave the same as horn, calcium and magnesium alone. It would thus appear that all effect was due to horn.

(*c*) Ground Horn with Calcium and Magnesium.

This treatment also was carried out on Penang soil. There was a drop compared with 10 cwt. horn alone from 2,385 to 1,740 gantangs (27 per cent.) with 10 cwt. of mixed calcium and magnesium salt, while with 40 cwt. of each the yield dropped from 2,565 for 40 cwt. of horn alone to 2,120 gantangs.

C. Comparison of Soluble with Insoluble Nitrogen.

The marked differences during growth have already been discussed under that heading. The two soils used for this comparison were Malacca and Titi Serong. The former received a dressing of 30 cwt. of superphosphate throughout, the latter nitrogen alone. It has been remarked above that Malacca probably shews a depressed effect due to excess of superphosphate. Nevertheless, the observations made during growth were amply confirmed at harvest.

For Malacca 2 cwt. form: urea gave 500 gantangs; 2 cwt. of ammonium sulphate gave 390; 30 cwt. form: urea gave 2,435, while 30 cwt. ammonium sulphate gave 817 gantangs. The significant difference was 138 gantangs.

In the case of Titi Serong 2 cwt. form: urea gave 995 against 695 for 2 cwt. ammonium sulphate; 30 cwt. form: urea 2,170 against 1,800 for 30 cwt. ammonium sulphate.

The results thus obtained are interesting in view of the observations made on soils kept under anaerobic conditions in the laboratory, to be described in the next issue.

To sum up the observations on nitrogen, it would seem that yields well above the "bar" can be obtained with this dressing alone* if present in sufficient quantity; with fairly small quantities in insoluble form; with large quantities in the form of ammonium sulphate. Ground horn is the only one of those tried which has any practical possibility and the question of costs and supplies is being further considered.

D. Calcium and Magnesium.

These have already been considered in combination with nitrogen and phosphates but the observations were confined to the other element present.

(1) *With Phosphate.*

With Kuala Pilah soil the calcium-magnesium mixture was tried with superphosphate in combination 10 and 10, 30 and 30 cwt. With 10 cwt. the yield was less by 28 per cent. than with 10 cwt. phosphate alone. With 30 cwt. this was reversed, the yield being 50 per cent. higher than with the corresponding amount of phosphate alone. On Kamunting the corresponding combinations were 10 and

* Economics are not to be considered here. The object in the first place is to get above the "bar".

10, 40 and 10, 10 and 40 and 40 and 40 for phosphate and calcium-magnesium respectively. In each case, with the exception of 10 and 10, the yield was less than phosphate alone. The higher dressing gave the poorer result.

(2) *With Nitrogen.*

For this purpose Penang soil was used and nitrogen was in the form of ground horn. The combinations were 10 and 10, 10 and 40 for nitrogen and the calcium-magnesium mixture respectively. In each case the yield was less than with nitrogen alone.

(3) *With a Complete Heavy Dressing.*

On Selinsing soil 30 nitrogen, 30 superphosphate and 22 potash was tried without and with 30 calcium-magnesium mixture. The respective yields were 1,610 and 2,415 gantangs. Here the increase of the latter over the former is marked, being just 50 per cent.

From this it would seem that results are somewhat inconclusive but on the whole the evidence is in favour of non-utility of such a calcium-magnesium mixture.

E. Silica.

In the previous year, as already stated above, the addition of 10 cwt. of sodium silicate gave nine positive increases out of thirteen trials.

In the case of Penang soil in all combinations (*i.e.* with 40 cwt. of horn and 10 and 40 cwt. of horn + calcium-magnesium mixtures) the results were the same as for those without silica.

On the very poor Kuala Lumpur soil it greatly improved growth as the sole manure, though no crop was obtained. An increase of over 100 per cent. was obtained in combination with 10 cwt. of superphosphate, a slight decrease with 20 cwt. of the latter, and about 20 per cent. increase with 40 cwt. It should be remembered that the higher phosphate repressed the yields.

On the whole, silica seems to be of some importance on a poor soil. It should be stated that all the positive results of 1934 were with considerably smaller quantities of phosphate and nitrogen than were used in 1935.

F. Peat.

The details of the addition of peat are given above. In every case there was a large drop in yield; the percentage drop was considerably greater on the poorer-yielding soils and where too heavy dressings of phosphate had a depressing effect.

G. Complete Heavy Dressings.

Only two sets of Selinsing soil were available for this and they have been commented on under Calcium and Magnesium. The mixture in the one case was 30 cwt. ammonium sulphate, 30 cwt. superphosphate and 22 cwt. potash. This yielded 1,610 compared with 1,060 gantangs for 2 cwt. of humic acid. With the further addition of 30 cwt. calcium-magnesium mixture the yield was 2,415 gantangs.

H. The Effect on Leaf and Stalk.

Although the percentage increase in grain is of prime importance, yet the effect of many of the above dressings on purely vegetative growth was so marked (as will be seen from the photographs) that it is of interest to comment on it.

Taking Malacca and Titi Serong as the outstanding examples where light and heavy, soluble and insoluble dressings of nitrogen were given, the tillering figures are of great interest:—

Mean Tillers per Plant.

	2 cwt. sol.		2 cwt. insol.		30 cwt. sol.		30 cwt. insol.	
	Mal.	Titi Serong	Mal.	Titi Serong	Mal.	Titi Serong	Mal.	Titi Serong
At 2 months ...	5.92	6.34	5.25	5.72	3.58	5.51	12.68	9.59
At harvest ...	4.08	6.25	4.42	5.84	8.77	8.5	18.60	12.0

These figures suggest that there was not enough nitrogen available through the season with the lighter dressing either of insoluble or soluble.*

The extraordinary heights to which some of the padi grew (7 feet 3 inches maximum) has already been mentioned. It was found that the higher the padi grew the greater was the tendency for lodging to take place. In general, the better the crop the taller the padi. It should be noticed that at two months the increase in height compared with the control year is anything from 15 to 200 per cent., and at harvest anything up to 70 per cent. higher. The increase in tillering is about 100 per cent.

Nitrogen was determined on leaves and stalks for each manurial series in triplicate, but no correlation was found between the nitrogen content and weight of leaf or stalk.

J. Results from Artificial Lighting.

Remarks have already been made on general growth differences between normal and artificially-lighted padi. The results in yield have been entirely different. With artificial light a very large percentage of the ears were completely empty, while almost all ears turned a reddish brown on ripening.

Individual comparison is made below.

Phosphate Alone.

Kuala Pilah soil. With 10 cwt. of superphosphate a total yield of 695 gantangs was obtained, but 55 per cent. of this had empty glumes. This compares with 2,020 gantangs for normal lighting.

* For remarks on number of tillers, see page 330.

TABLE III

The Effect of Artificial Lighting.

Soil and Treatment	Yield in Gantangs (measured) (a) full glumes	(b) empty glumes	Soil and Treatment	Yield in Gantangs (measured) (a) full glumes	(b) empty glumes
Kuala Pilah 4 tons G.M.			Kuala Pilah Peat		
(a) 10 cwt. P_2O_5	395	300	as (a) ½ Kgm. peat	145	645
(b) do. 10 cwt. CaMg	135	1240	as (b) 1 „ „	110	1290
(c) 30 cwt. P_2O_5	305	600	as (c) 1½ „ „	340	1550
(d) do. 30 cwt. CaMg	405	1160	as (d) 2 . „	308	1290
Titi Serong			Raub High-yielding		
2 cwt. form: urea	495	1960	10 cwt. P_2O_5 10 cwt. form: urea	555	615
30 cwt. „ „	610	600	„ „ 40 cwt. „	358	830
2 cwt. am. sulphate	450	935	40 cwt. „ 10 cwt. „	290	355
30 cwt. „ „	415	310	„ „ 40 cwt. „	640	580
Selinsing			Malacca 30 cwt. P_2O_5		
2 cwt. humic acid	415	900	2 cwt. form: urea	280	355
20 cwt. „ „ ...	335	395	30 cwt. „ „	195	515
30 cwt. P_2O_5 30 cwt. am. sulphate			2 cwt. am. sulphate	210	545
22 cwt. K_2SO_4	605	815	30 „ „ „	380	335
- do. - - do. - + 30 cwt. CaMg	570	415			
Lenggong 4 tons G.M.			Lenggong Peat		
(a) 10 cwt. P_2O_5	735	515	as (a) ½ Kgm. peat	450	20
(b) 20 cwt. „	610	860	as (b) 1 „ „	305	10
(c) 40 cwt. „	695	730	as (c) 1½ „ „	430	40
(d) 60 cwt. „	460	370	as (d) 2 „ „	535	45

In the case of Lenggong soil, comparisons were made with 10, 20, 40 and 60 cwt. of superphosphate. It will be seen that in each case the yield is very much smaller for the artificially lighted padi and that, in addition, the percentage of empty glumes varies between 40 and 60 per cent. In those pots to which peat had been added drop in yields was not pronounced but the percentage of empty glumes was only between three and nine per cent.

Phosphate and Nitrogen.

On Raub high-yielding soil the yields varied from 70 to 50 per cent. of the normal lighted pots with about 50 to 70 per cent. of empty glumes.

Form: urea. Complete Heavy Dressing and Phosphates with Calcium and Magnesium, Humic Acid.

In each case the artificial lighting caused a drop of from 30 to 50 per cent. in yield with about 50 to 70 per cent. of empty glumes.

It is of interest to compare the results obtained with those of Yataka Fuke whose paper has already been mentioned. He found that (i) increase in the growth period was roughly proportional to the number of days of artificial illumination, (ii) the delay period varied with the variety, (iii) with some varieties flowering took place while undergoing artificial light treatment, (iv) with some varieties no flowering took place as long as artificial lighting was continued.

In no case, however, is any mention made of empty glumes or other abnormality of the padi obtained.

Etiolation Experiments.

It has recently been found that by etiolation the maturation period of maize can be shortened sufficiently in temperate climates for it to mature during the summer months with long daylight. (In Malaya with its short day the maturation period is only three months).

It therefore seemed possible that a heavy-yielding Seraup padi with an eight months maturation period might have its growth period shortened by etiolation.

On the suggestion of the Chief Research Officer, S.S. and F.M.S., a small amount of a Seraup padi was etiolated for nine days and was then planted out in different soils side by side with a Radin.

For reasons of space it was found necessary to place the pots for this experiment close to the illuminated cage and the effect of this was undoubtedly to cause a certain amount of extra vegetative growth owing to the reflected light, so that the Radin flowering was retarded by nearly two months. The Seraup, however, flowered at the same time so that there was apparently some decrease in the maturation period. As this was initiated in the middle of the padi season it was not possible to lay down a fully controlled experiment and the result obtained is only of a preliminary nature.

Soil under Fallow.

Since the harvest has been completed it is very noticeable that there are great differences in the weed growth in the different soils after drying out. This applies both to quantity and species. A casual examination seems to shew that for

a given soil the growth is consistent in every pot and that the richer soils have the sturdier growth. At the time of writing, an ecological examination is being carried out which will be incorporated in the next report.

Comments.

One point of great importance in a consideration of these results is the actual quantity of grain per plant. Field experience has shewn that the number of tillers per hill has a tendency to be constant whatever the number of plants. Turning to the actual figures *per plant* in these experiments it will be seen that they are low, while tillers are also lower than field numbers. On the other hand, the space occupied by the three plants in the pot is only twenty-four per cent. more than occupied by one "hill" in the field (12 inches by 12 inches planting) which may consist of one, two or three or even more plants per hill. As it has been found in the latter case that the tillers per hill tend to a constant number it seems most probable that the three plants per pot should only be regarded as occupying one hill. In this connexion the figures given for variation in tillering with planting distance in the *Malayan Agricultural Journal* for December 1933, page 637, are of interest where, for planting distances of 15 inches, 12 inches and 9 inches square respectively, the tillering numbers at harvest are of the order 15, 12 and 8 so that with a planting distance of $7\frac{3}{4}$ inches a figure of 6 would appear to be about normal.

The object of pot experiments such as these is to indicate the lines which future trials should take and to show where the more positive results are likely to be obtained.

The balance of evidence is that yields obtained were in effect a good measure of the efficacy of the treatments tried out, but, even if this is so, it seems unlikely, unless the price of the materials used is very considerably lowered, that such dressings have any immediate possibilities. It is essential, however, that this particular sphere should be more closely examined in order that complete conclusions can be drawn.

Certain further lines of investigation in pots are indicated to answer the following questions:—

(1) Have these high dressings of insoluble nitrogen and/or acid phosphate a sufficiently large residual effect to bring their use within economic limits.

(2) What is the minimum nitrogen dressing either soluble or insoluble which will bring yields well above the "bar" (No trials were made between 2 and 20 cwt. of soluble or between 2 and 10 cwt. of insoluble nitrogen).

(3) A large amount of data is now available on dressings between 1 and 3 cwt. and results are shewn here between 10 and 60 cwt. of phosphates. Would dressings of basic phosphate or the comparatively cheap rock phosphate dust between 4 and 10 cwt. have the desired effect of raising yields above the "bar" and have such dressings any residual effect of economic worth.

(4) The question of green matter requires further investigation. Extensive experiments have been carried out with green matter buried and left on the surface but all such experiments have only been carried out with green matter grown *in situ*. The so called 'batas'* effect may be due to a concentration of nitrogen along the edge of the batas but it must be borne in mind that the batas is made up from green material grown over a large area and not that in the immediate vicinity.

It must be decided whether any quantity of green matter, however high, will raise yields above the bar.

(5) Can nitrogen in a cheap soluble form be successfully added to the irrigation water at the padi field intake, to form a constant supply of available nitrogen.

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* Batas = small bund made up from green matter grown in the padi field during the non-padi season.

Batas effect.—It is usually noticeable that padi growing close to the batas gives a higher yield than that growing in the centre.

COPRA MANUFACTURE.

Part II—Kilns of Intermediate Size.

BY

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Introduction.

In the first of this series of articles,* two small and inexpensive copra kilns of wooden construction were described. Sufficient time has now elapsed, since this account appeared, to show that either of these kilns will give good results in the hands of small-holders if the coconuts are split at the kiln side and converted without delay into copra. Nevertheless it has been found that neither of the two kilns has aroused any considerable degree of interest.

It has emerged that the "30 acre" kiln with a capacity for 350 nuts and, depending on local circumstances costing between $10 and $20 to build, is regarded as being large enough only for properties of less than 3 acres, while the "10 acre" kiln is generally considered to be much too small.

It now appears that the new type of small copra producer who has started manufacturing copra himself, almost invariably requires a kiln for much less frequent use than the middleman or shop-keeper copra producer whom he is replacing, and whose kiln, operated on bought nuts, is generally in regular use. The standard harvesting procedure on small holdings is to collect the whole of the crop once every two months. If the holding is small, the nuts may be brought in whole and husked at the kiln side, but on slightly larger properties where nuts have to be carried in bags or where nuts are brought in from surrounding holdings, they are received at the kiln side in a split condition and must therefore all be dried without delay.†

Where the same men collect, husk and split the nuts, and later dry the copra, it is obvious that the kiln must be of such a size that the whole of one day's collection of split nuts can be loaded on to the kiln the same day, irrespective of whether the copra is dried slowly on the crude kilns or rapidly on the new kilns.

A survey of some 40 kilns in one important coconut district provides the data tabled below regarding copra driers of all sizes and condition used on properties of various sizes.

It will be noted that kilns for the small acreages require to be disproportionately large when compared with the kilns for the larger properties and also that there are no kilns, even on the smaller properties, with a capacity of less than 500 nuts.

* *Malayan Agricultural Journal*, Vol. XXIV, April 1936, page 167.
† *Malayan Agricultural Journal*, Vol. XX, July 1932, page 351.

No. of Examples	Nut Capacity of Kiln	Usual Cost of Kiln	Usual Acreage of Coconut Land. Owner. Suppliers. Total.
6	500 to 600 nuts	Nil to $ 5	2 + 1 = 3
8	700 to 800 ,,	Nil to $10	3 + 5 = 8
6	1000 to 1500 ,,	Nil to $30	5 + 15 = 20
6	2000	$ 5 to $200	Various = 30
6	3000	$10 to $250	Various = 50
1	5000	$380	20 + 60 = 80

At the present time, the typical 3 acre small-holder, having a crude kiln with a capacity of say 600 nuts, need only load his kiln once or perhaps twice every two months according to the crop to be dealt with and he will obtain saleable, if under-dried and poor quality, copra with only about a week's work, inclusive of collection and preparation.

With an improved kiln, having a capacity of only 100 nuts, he would have to devote ten to twelve days to drying alone, and this he is not prepared to do even to obtain better copra.

It is apparent from the preceding table that the so-called "30 acre" kiln, with a capacity of 350 nuts, is actually only best suited to 1 to 3 acre properties, the owners of which are at present mostly selling their nuts to the Chinese or Malay owners of large kilns. The owners of such small properties, however, generally lead a hand-to-mouth existence and cannot afford the money necessary to build a plank kiln, costing even as little as $10.

It follows, from the foregoing, that the system of naming kilns on the basis of maximum mature acreage and regular operation is unsatisfactory. Nut capacity as an indication of the size of a kiln can also be misleading, since the old type of smoke kiln requires three days to produce dry copra, while the new kilns, requiring only one day, have an operating capacity three times as great as their total nut capacity indicates.

In order to prevent confusion it has been decided to adopt a system of numbering for the various kilns based on acreage and nut capacity. The new numerical designations indicate directly, more particularly in the case of the smaller kilns, the acreage of good coconuts for which such kilns can be regarded as suitable with intermittent operation; they can also be used to determine the approximate nut capacities of the several kilns by multiplying the various reference numbers by one hundred, while the acreage of good mature coconuts which the kiln could serve, if operated regularly, is obtained by multiplying by ten.

The original "10 acre" kiln will in future, be known as kiln Type 1, and the "30 acre" kiln as Type 3. Similarly other recently proved models are kilns Types 4, 5, 6, 7, 8 and 15. It will be seen that the new system is capable of extension whenever fresh types are satisfactorily evolved.

Kilns of Intermediate Size.

A number of larger kilns operating on the same principal as kiln Type 3 (the original "30 acre" kiln) have been built and tested.

In the light of what has been written previously, it seems probable that the various needs of individual small-holders will be satisfactorily met by one of these larger kilns, and where a kiln is required for regular use, the largest of these—kiln Type 15—will be found equally suitable for an individual working a 100 acre coconut estate, or for grouped production by a co-operative society, a syndicate, or by a large buyer of coconuts.

The following three types are described in detail:—

Type 7—An enlarged single chamber kiln with room for two fires burning simultaneously.

Type 8—A twin kiln consisting of two Type 3 kilns built together, with a common dividing wall.

Type 15—A twin kiln consisting of two Type 7 kilns built together, similarly to Type 8.

These kilns have, in trials, given white dry copra, without any preliminary sundrying, in 24 hours or less.

Kiln Type 7.

This kiln, which can dry between 700 and 800 nuts per day, is an enlargement of the standard Type 3 kiln and must be regarded as suitable for small-holders who own or are able to obtain the crop from between 3 and 10 acres of coconuts.

It has been found that the Type 3 kiln may satisfactorily be made wider and longer, without affecting the high performance of this new design by

(a) raising the copra grill 12 inches, and

(b) by having two fires in the fire-pit.

It has been shown by experiment that, with a 7 foot fire-pit, the effective hot zone in the bed of copra immediately over a double-shell fire is covered by a circle 5 feet in diameter. This fact determines the width of a kiln with a 7 foot fire-pit.

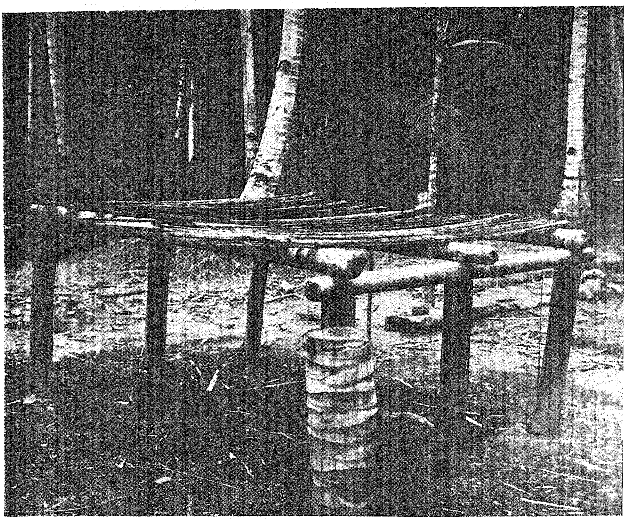
It has been found* satisfactory to have two fires, one burning from each end of the kiln inwards towards the centre, providing one chain is twice as long as the other. Both chains are lit at the same time in the wing extensions of the kiln, but the fires never meet since one fire goes out before the other. Thus the copra grill may be lengthened from 6 feet using one fire, to 10 feet with two fires.

A refinement which is possible with the 7 foot fire-pit, since there is sufficient headroom, is the use of a heat spreader. The spreader consists of a piece of flat sheet iron which is placed directly over the centre of the hearth. Since the centre of the travelling circle of heat is hottest, this heat spreader serves to make

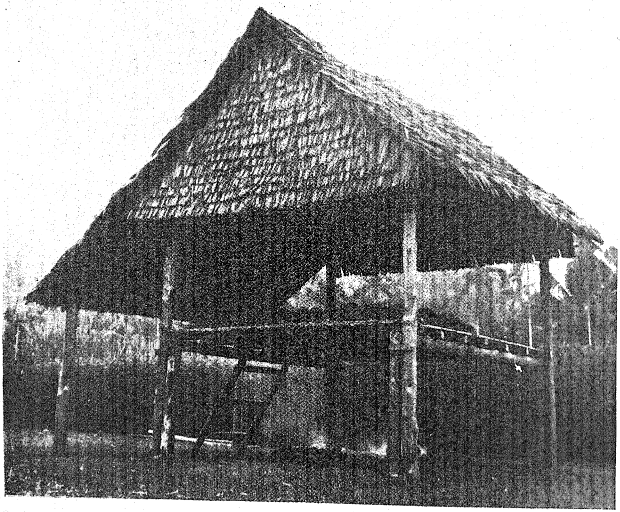
* It must be noted that it is not safe in these high-speed smoke-drying kilns to increase the number of fires beyond two, since, with three or more short fires in line, the fires at both ends of the line are attracted towards the middle fire or fires which mount up dangerously and scorch the copra, while elsewhere the material remains cold.

Under Construction.

The Finished Kiln.
Ventilation was arranged after this photograph was taken.



Primitive Copra Kiln.



Typical Kampong Kiln.
Showing smoky, disturbed fires.

temperature conditions within the kiln still more uniform and is conducive to greater efficiency.

The heat spreader, which is 10 feet long and 6 inches wide, is securely suspended one foot below the copra grill, *i.e.* 6 feet above the hearth, and so extends down the centre of the kiln.

Description of the *Samai* Kiln Type 7.

General Arrangement.—The copra platform, 10 feet long and 5 feet wide, consisting of a grill of split nibong, is arranged 7 feet above ground level. The fire-pit is made 6 feet longer than the copra platform by means of two wing extensions, which give more room in the fire-pit, and so allow a long chain of coconut shells to be used. General details of construction and arrangement of doors and openings are the same as for the Type 3 kiln.

Walls.—The vertical walls of the kiln are composed of *samai* matting (*kajangs*), made of nipah leaflets, laid flat and stitched with rotan fibre. The matting is first tacked in position on the timber framework of the kiln and then secured by horizontal laths of split areca palm trunks. This type of matting is so air-tight that some provision for ventilation is necessary.

Roof.—The main roof, covering the 4 feet high box of the copra platform, is of *atap* with open eaves, while the wing extensions are roofed with flat galvanized iron covered with *atap* so arranged on a wooden frame as not to come in direct contact with the warm metal. This precaution is not on account of any fire risk but because *atap* is very friable after being scorched.

Hearth.—In this instance, the hearth was built of home-made bricks*, produced from non-peaty clay of a type obtainable in some of the coconut areas of the west coast of Malaya.

The bricks are arranged in two parallel lines as in the "30 acre" kiln, four bricks high, spaces for air-supply being left between each brick of the bottom row. The total length of the space available for shells is 13¼ feet, the two lines of shells, one 9 feet long and the other 4 feet long, being carefully separated by a barrier four bricks high placed across the hearth. The two ends of the hearth must be only two bricks high.

The shells forming the two chains are fitted loosely into one another with the concavities of each line so arranged that the two fires burn inwards.

Ventilation.—With these larger kilns, particularly when *samai* matting is used for the walls, it is necessary to make provision for ventilation.

This is effected by leaving a 2 inch space between two boards, 6 inches above ground level, at both ends of the kiln. This slit extends the whole width of the kiln. It is screened externally by a plank, while the incoming draught is diverted towards the ground by another plank laid parallel to the first inside the kiln, so that the fires are not disturbed.

The hot humid air from the copra passes out of the kiln through the 9 inch eaves of the *atap* roof.

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* See appendix.

Operation.—The split coconuts are thrown on the copra platform to form a bed 1 foot deep, without any special arrangement, except that the nuts on top are turned face downwards as in the case of kiln Type 3, the description of which should be referred to for minor details of procedure.

Owing to the fact that the grill is arranged at a higher level and that a heat-spreader is provided, it has not been found necessary to reduce the firing, as the copra dries, to avoid scorching the product. As each lot of shells is consumed, it is replaced by a similar arrangement of shells, the only difference being that the longer of the two lines of shell is arranged to burn alternately from each end of the kiln. It is important that an interval of one hour should elapse between the time one set of fires is finished and the next is lighted; this allows the copra to cool a little and reduces the risk of scorching.

The copra should be turned after the second lot of fires is finished in order to bring the dry copra from the bottom of the bed to the top, and so obtain an evenly-dried product.

Each of the sets of fires lasts for about 4 hours, depending on the dryness and the size of the shells used. It has been found that the fires need be renewed only four times, and that, allowing hourly intervals between successive fires, dry white copra can be obtained in 19 hours, providing well-dried shells have been used as fuel and the ground on which the kiln stands has dried out properly.

The kiln has a standard capacity of 750 nuts, 1,080 pieces of half-shell being used as fuel. Thus a considerable surplus of shell is available after every run and good, clean, unbroken shells of even size for use in the fire-pit can be selected.

In the construction of this kiln *samai* matting was used for the walls, *atap* for the roofing, jungle timber for the supports and home-made bricks for the hearth. At the demonstration centre, the cost of this kiln, inclusive of labour transport and materials, was $35, but in the kampong only small items such as the planks, sheet iron, brushes and nails, and also Solignum for use as an external preservative for the *atap* and timbers, need be purchased.

If planks are used throughout, the kiln would cost about $40, inclusive of labour and transport.

Life and Capital Cost.—In spite of the very combustible nature of *samai* matting, the fire risk is negligible unless the operator is careless in bringing burning shell from outside into the kiln, and if the *samai* matting is carefully treated with solignum externally and the posts are also dipped before erection, a life of 3 years may safely be anticipated.

If the kiln is in regular use and operated for 200 days in every year it should be able to deal with 150,000 nuts or 600 piculs of copra obtained from about 70 acres of coconuts. Thus, assuming the kiln is built of planks, instead of *samai* matting, the capital cost spread over two years is equivalent to only 2 cents per picul or 50 cents per acre.

If the kiln is only worked intermittently *i.e.* once every two months, it would treat only about 5,000 nuts per annum, equivalent to 20 piculs of copra, or twice

Operation of Type 7 Kiln.

	Fires.		Time.
1st set of fires.	→ 190 pieces.	80 pieces. ←	4 hours.
	Wait.		1 hour.
2nd set of fires.	→ 80 pieces.	190 pieces. ←	4 hours.
	Turn the copra and wait.		1 hour.
3rd set of fires.	→ 190 pieces.	80 pieces. ←	4 hours.
	Wait.		1 hour.
4th set of fires.	→ 80 pieces.	190 pieces. ←	4 hours.
	Copra off.		
	Overall time		19 hours.
	Net firing time		16 hours.

NOTE.—If the night fire is lighted at 9 p.m. and is not renewed till morning, the overall time is 24 hours.

Performance.

No. of nuts dried	750	
No. of shells used	540	
Surplus fuel	210	complete shells.

this quantity if used once monthly. In the first instance a *samai* kiln costing $5 represents a capital charge of 8 cents per picul of copra, or $2 per acre of coconuts.

Details of the Type 7 Kiln.

Cost.

Amount.	Materials.		Approximate Cost.
			$
1 gallon	Solignum	...	2.25
1	Paint brush	...	0.25
12	Areca trees	...	3.60
200	*Ataps*	...	2.00
21 sheets	*Samai* matting 7 ft. x 4 ft.	...	6.30
6 kati	Wire nails (various)	...	0.42
8	Hinges	...	0.32
1 bundle	Rotan	...	0.16
2 pieces	Corrugated iron 8 ft. x 1 ft. 6 in. x 1/32 in.	...	1.80
15	Light poles 20 ft. x 2 in.	...	2.40
2 sheets	Ridging 6 ft. long	...	0.60
4	Meranti planks 16 ft. x 7 in. x 5/8 in.	...	1.00
7	Meranti scantlings 16 ft. x 2 in. x ½ in.	...	0.42
200	Bricks	...	3.00
15	*Atap* sticks	...	0.45
	Total	...	$24.97
	Total, including labour and transport, (approximately)		$35.

Kiln Type 8.*

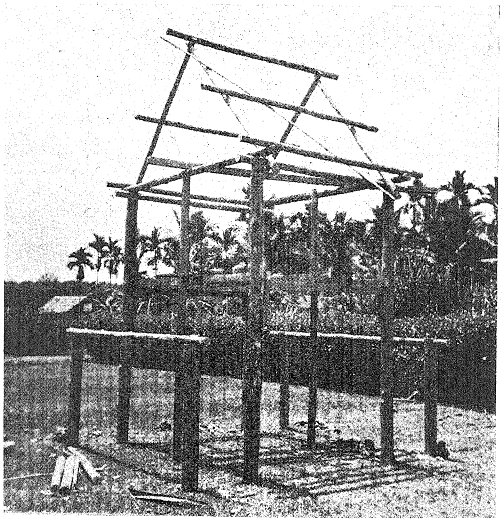
Like the Type 7 kiln, this kiln is similar in principal to the standard Type 3 kiln. It has, however, nearly three times the capacity of this 350 nut kiln, and a small-holder, owning 10 acres of coconuts, can convert a two-month's harvest of coconuts into copra in 6 to 8 days, while, with continuous working, it can, as its type number indicates, deal with the crop from an 80 acre estate. This kiln is, however, likely to attract most attention among small-holders who can obtain the crop from between 5 and 15 acres of coconuts, part of which crop may be bought or leased.

Description of the Kiln.

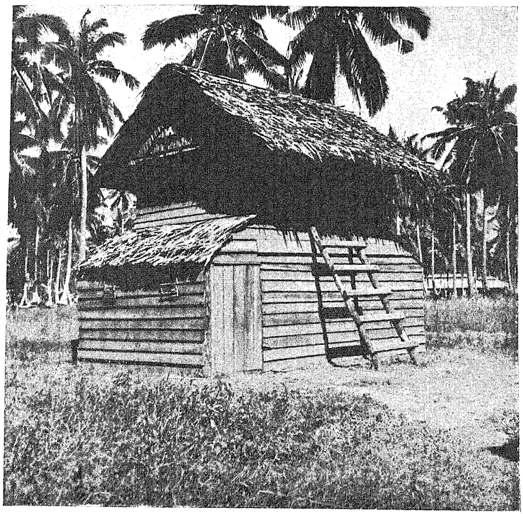
General Arrangement.—The kiln may be described as two slightly enlarged Type 3 kilns, placed back to back, and having a common back wall, the design being modified in certain respects to suit this arrangement. Like the Type 3 kiln, it is a closed, *atap*-roofed, plank building. The area covered is 14 feet

* This account is contributed by Mr. C. W. S. Hartley, Agricultural Officer, Perak South.

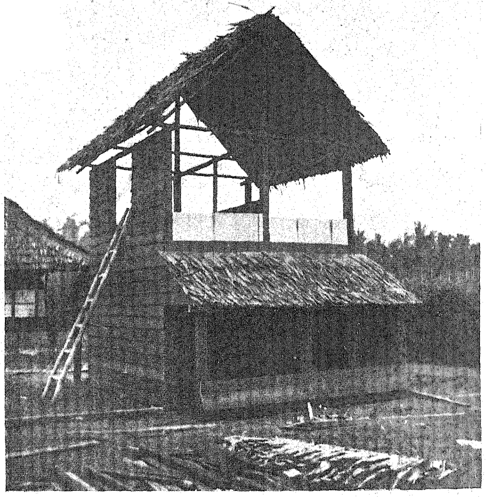
KILN TYPE 8



Framework of the Kiln.



The Kiln—built of Planks.



Under Construction.
Shewing ventilation arrangement and fire passage.

The Finished Kiln.
Shewing the lean-to at rear for shelling and bagging the copra.

by 8 feet and the height to the eaves is 10 feet. The copra platform is 8 feet square and is set at a height of 6 feet above ground level. A plank partition runs longitudinally through the middle of the kiln, thus dividing it into two halves, each with its own fire-pit.

The Fire-Pits.—The fire-pits are each 14 feet long and 4 feet wide and are thus 6 feet longer than the copra platform. Entrance to each fire-pit is by a door 4 feet in height and 3 feet wide, placed at the end of the long side of the kiln. The door of one fire-pit is at the opposite end of the kiln to that of the other. This arrangement allows the two fires to be lighted at opposite ends of the kiln. Screened ventilation through a 2 inch slit may be provided as described previously but is not an essential adjunct.

The Copra Platform.—The platform is composed of nibong slats, overlaid with close mesh wire netting, and surrounded by four plank walls to a height of 4 feet. A pair of double doors in one wall gives access to the platform.

A partition runs longitudinally across the drying platform as a vertical extension of the partition, dividing the two fire-pits. This partition is, however, loose and can be laid flat when the split nuts are being thrown on the half of the platform which lies furthest from the door. A partition across the drying platform is advisable, as it helps to maintain a thorough distribution of the heat from the two fires. Without a partition and with a strong side wind, the heat would tend to be concentrated on one side of the kiln and the copra there might become scorched.

The Roof.—The kiln is covered with an *atap* roof, overhanging 1 foot all round and leaving a gap at the eaves of about 9 inches to permit the escape of humid air. The two sloping roofs of the fire-pit extensions are made of flat galvanized iron covered by *atap*, which must be built on a wooden frame and not laid directly on the hot metal.

Operation.—The operation of this kiln is similar to that of the Type 3 kiln. A double chain of coconut shells, 12 feet long, is laid in each fire-pit between two lines of loose serrated brick work. The nuts are split and thrown on the platform without any special arrangement.

Using good-sized nuts and clean, well-dried shells it has been found that two firings, using double lines of shells, followed by three firings, using single lines of shells, give good results. Thus, good copra can be obtained after 25 to 30 hours drying. The number and intensity of the fires required, however, depends on a number of factors which must be determined independently for each kiln and the most important of which are:—

(a) The number and size of the nuts comprising the charge.
(b) The size of the shells used for fuel.
(c) The dryness of the shells.
(d) The packing of the shells.
(e) The adequacy or otherwise of the ventilation.

Operation of Type 8 Kiln.

	Fires.	Time.
1st set of fires.	240 pieces 240 pieces	$5\frac{1}{2}$ hours.
	Turn copra and renew fires.	$\frac{1}{2}$ hour.
2nd set of fires.	240 pieces 240 pieces	$5\frac{1}{2}$ hours.
	Renew fires.	$\frac{1}{2}$ hour.
3rd set of fires.	120 pieces 120 pieces	$5\frac{1}{2}$ hours.
	Turn copra and renew fires.	$\frac{1}{2}$ hour.
4th set of fires.	120 pieces 120 pieces	$5\frac{1}{2}$ hours.
	Renew fires.	$\frac{1}{2}$ hour.
5th set of fires.	120 pieces 120 pieces	$5\frac{1}{2}$ hours.
	Overall time	$29\frac{1}{2}$ hours.
	Net firing time	$27\frac{1}{2}$ hours.

NOTE.—If the kiln fires are not renewed at night, the overall time is $34\frac{1}{2}$ hours.

Performance.

No. of nuts dried	1,000
No. of complete shells used	840
Surplus fuel	160 complete shells.

Each fire lasts between 5 and 6 hours, the time depending on (b), (c), (d) and (e) above, and the firing requirements being to this extent a matter for experiment.

The copra should be turned after the first and third fires, since good turning results in an evenly dried sample.

Life and Capital Cost.—The materials used for this kiln are the same as those used for the Type 3 kiln. If all the materials are bought new at current market prices, the cost will be about $36. In many localities, however, the small-holder can obtain a large proportion of the materials free or at a greatly reduced cost. The kiln may then cost as little as $14. If a carpenter is employed, the cost will be increased by $8 to $10. Transport costs, if any, will also have to be added to complete the total cost, but these will vary considerable according to the situation of the kiln.

At the Coconut Experiment Station, Port Swettenham, a twin kiln of this size has been constructed satisfactorily of *samai* matting and, on it, 900 nuts were dried satisfactorily in 22 hours overall time (18 hours net) using 1,150 pieces of half shell. The cost of this kiln including labour and transport was $40 but, as most of the materials used, including bricks, can be obtained or made for nothing, the actual cost of the kiln need not exceed $9, including Solignum for preserving the *atap* and timbers.

Details of The Type 8 Kiln.

Cost.

(1) Using new materials at current market prices.

Amount.	Materials.			Approximate Cost
				$
6	Bakau posts at 30 cents	16 ft. x 5 in.	...	1.80
100	*Ataps*		...	1.60
65	Planks at 24 cents	7 in. x $\frac{3}{4}$ in. x 16 ft.	...	15.60
8	Broties at 30 cents	2 in. x 3 in. x 16 ft.	...	2.40
12	Broties at 24 cents	$1\frac{1}{2}$ in. x. 3 in. x 16 ft.	...	2.88
180	Bricks at $1.60 per 100		...	2.88
8	Hinges		...	.24
2 kati	Nails		...	.14
6	Galvanized iron sheets at $1.20		...	7.20
16 feet	Wire netting, at 8 cents per ft., 4 ft. wide		...	1.28
54	Nibong slats from 11 poles at 10 cents		...	1.10
		Total	...	$37.12
	Total cost, including labour and transport (approximately)		...	$45.00

(2) To Small-holders (Estimate).

Amount.	Materials.	How obtained.	Cost
			$
6	Bakau posts	Free from Bakau Reserves ...	—
100	*Ataps*	Free or bought ...	1.50
60	Planks	Obtainable cheap—old or under full length ...	3.60
8	Broties (2 in. x 3 in. x 16 ft.)	Remaining broties obtainable free ...	2.40
180	Bricks	Sometimes obtainable cheap from old buildings or else home-made ...	2.88
8	Hinges	...	—
2 kati	Nails	...	.24
6	Zinc or iron sheets	Flattened old sheets ...	.14
16 feet	Wire netting	...	1.10
54	Nibong slats	Sometimes obtainable locally free	1.28
			$13.14

Kiln Type 15.

This kiln, which can deal with 1,500 to 1,800 nuts per day, consists of two Type 7 kilns built together to form a twin kiln in the same way as kiln Type 8 is a twin of two slightly enlarged Type 3 kilns. While, as its type number indicates, this larger kiln is suitable for an estate of 150 acres it will probably prove most popular among the small-holders who, owning a small plot of coconut land themselves, are able to secure the crops from adjoining properties, totalling in all between 15 and 30 acres.

Details of Kiln.

General Arrangement.—The common partition, dividing the two chambers, is extended upwards eighteen inches above the copra grill and, if required, the part above the grill can be removable in order to facilitate working on the copra platform.

The partition in the fire-pit is not extended laterally into the wings of the kiln which are left freely accessible to allow the fireman to enter the fire-pits of either chamber whenever he wishes. A door is provided at each end of one long wall, while one set of double doors give access to the copra platform.

As in Type 7 kiln, heat spreaders are used, one being required for each section.

Operation.—With the 7 foot fire-pit, double lines of shells can be used throughout the period of drying and no scorching occurs so long as hourly intervals are

Operation of Type 15 Kiln.

	Fire.		Time.
1st set of fires.	190 pieces	80 pieces	$4\frac{1}{2}$ hours.
	80 pieces	190 pieces	
	Wait.		1 hour.
2nd set of fires.	80 pieces	190 pieces	$4\frac{1}{2}$ hours.
	190 pieces	80 pieces	
	Turn copra.		1 hour.
3rd set of fires.	190 pieces	80 pieces	$4\frac{1}{2}$ hours.
	80 pieces	190 pieces	
	Wait.		1 hour.
4th set of fires.	80 pieces	190 pieces	$4\frac{1}{2}$ hours.
	190 pieces	80 pieces	
	Copra off.		

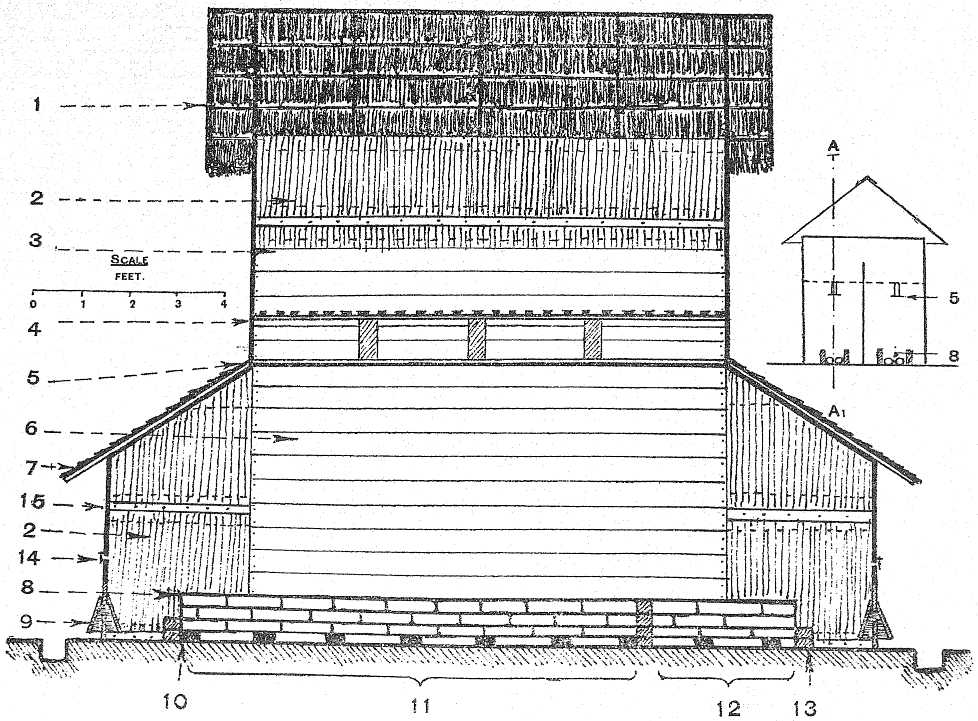
Overall time	21 hours.
Net firing time	18 hours.

NOTE.—If the night fire lighted at say 9 p.m. is not renewed till morning, the overall time is 27 hours.

Performance.

No. of nuts dried	1,500	
No. of complete shells used	1,080	
Surplus fuel	420	complete shells.

Kiln Type 15—with *Samai* Construction.



SECTION A. A1

Details of the Type 15 Kiln.

Cost.

Amount.	Materials.	Size.		Approximate Cost
				$
2 gallons	Solignum		...	4.50
1	Paint brush		...	0.25
75	Meranti planks	16 ft. x 7 in. x 5/8 in.	...	18.75
6	Changai poles	13 ft. x 4 in.	...	13.26
6	Changai poles	6 ft. x 4 in.	...	6.12
20	Broties (teak)	16 ft. x 3 in. x 2 in.	...	8.00
10	Broties (meranti)	16 ft. x 2 in. x 1 in.	...	1.20
55	Broties slats	16 ft. x 1 in. x 1 in.	...	3.30
6	Bakau poles	20 ft. x 2 in.	...	1.50
2	Bakau poles	10 ft. x 4 in.	...	1.20
30	*Atap* sticks		...	1.20
310	Bricks		...	4.65
5 pieces	Flat sheet iron	6 ft. x 1 ft. 6 in. x 1/32 in.	...	3.50
230	*Ataps*		...	2.30
3 bdls.	Rotan fibre		...	0.36
2 pieces	Ridging, 6 ft. long		...	0.40
12 hinges	4 in.		...	0.60
3 hinges	6 in.		...	0.20
10 kati	Nails, various		...	0.70
				$71.99
Total cost, including labour and transport (approximately)			...	$90.00

allowed between successive fires. The fire plan is not changed as the drying proceeds and is the same for each chamber as for the Type 7 kiln.

This twin kiln may be operated as a single unit, being loaded and emptied completely every 24 hours, or it may be worked in two halves, one half being used for freshly-split nuts while the other may be filled with semi-dried copra.

KILN TYPE 15.

Key to Diagram.

1. Main *atap* roof.
2. *Samai* matting walls.
3. Partition dividing copra.
4. Copra platform 7 feet above ground level.
5. Heat spreader 6 inches wide and 10 feet long.
6. Partition separating twin fire-pits.
7. *Atap* on wooden frame on sheet iron.
8. Hearth of loose brickwork, 4 bricks high.
9. Main ventilation, 2 inch screened slit.
10. Ventilation holes into hearth.
11. Space for 9 foot line of shells.
12. Space for 4 foot line of shells.
13. End wall of hearth, 2 bricks high.
14. Observation hole.
15. Pinang slats.

Thus 800 to 900 nuts can be brought in through the double doors on one side of the kiln every 12 hours after the equivalent of fully-dried copra has been ejected through a drop shutter on the far side of the kiln and the equivalent of semi-dried copra has been turned, so as to leave one half of the kiln empty.

Capital Cost.—If the kiln is kept in fairly regular daily use and operated throughout the night it can easily deal with 300,000 nuts per annum, equivalent to about 1,200 piculs of copra. The capital cost is about $90, which spread over three years, is equivalent to about 2½ cents per picul of copra, or 50 cents per acre.

It is anticipated that, in the kampong, the kiln could be erected by the owner himself, while cheaper materials could be used, so that it need cost only about $40. In this case, the capital cost of the kiln if used intermittently for a small acreage of coconuts is equivalent to about 8 cents per picul of copra or $2 per acre, which figures may be used as a guide in determining the apportionment of the cost when the kiln is operated on some form of share basis.

Acknowledgment.

The writer wishes to express his appreciation of the valuable assistance which Inche Abdul Rahman, Conductor of the Coconut Experiment Station, Port Swettenham, has rendered in building the various kilns and conducting the trials.

Summary.

Unscorched dry white copra can be obtained in 24 hours or less if the whole of the copra on a kiln is continuously heated and there are no cold spots. The kiln must be of a certain design to achieve this.

A number of very inexpensive kilns constructed of wood and *atap*, which will dry copra rapidly, and which have been built and operated successfully, are described.

APPENDIX I.

List of Small Kilns which may be inspected at the Coconut Experiment Station, Port Swettenham.

Type No.	Description	Platform Size and Area	Fire-Pit Height	Capacity (Nuts)
		EARLY KILNS.		
5A	Crude kampong kiln	10 ft. x 10 ft. = 100 sq. ft.	4 ft.	1,500
6A	Enclosed clay kiln	10 ft. x 10 ft. = 100 sq. ft.	6 ft.	1,200
7A	Experimental brick kiln	11 ft. x 10 ft. = 110 sq. ft	7 ft. 6 in.	1,500
		NEW TYPE KILNS.		
1	Cabinet (plank)	3 ft. x 3 ft. = 9 sq. ft.	6 ft. tunnel.	100
3	Single chamber (plank)	6 ft. x 3 ft. 6 in = 21 sq. ft.	6 ft.	300 to 350
4	Single chamber (*samai*)	8 ft. x 4 ft. = 32 sq. ft.	6 ft.	400 to 450
6	Twin (plank)	6 ft. x (4 ft. + 4 ft.) = 48 sq. ft.	6 ft.	600 to 650
7	Single chamber (*samai*)	10 ft. x 5 ft. = 50 sq. ft.	7 ft.	700 to 800
8	Twin (*samai*)	8 ft. x (4 ft. + 4 ft.) = 64 sq. ft.	6 ft.	800 to 1,000
15	Twin (plank)	10 ft. x (5 ft. + 5 ft.) = 100 sq. ft.	7 ft.	1,500 to 1,800

Warning.

With regard to the new type kilns, since the dimensions of the standard Type 3 have an experimental basis, any large departure from the specifications given above is not recommended. A considerable increase in either the length or breadth of the copra platform, for instance, will materially prolong the time of drying, since the copra outside the hot zone of the travelling cone of heat will remain cold for a longer time, while, away from the fires, cold air may actually pass down through the copra and so spoil the product. This occurs on the old Type "A" kilns which required two, three or even four days to dry copra properly, according to their size.

It may be noted that kiln Type 8 has 2 feet added to the length and 6 inches to the breadth of the grill of the standard Type 3 kiln, and the effect of these additions is to necessitate a longer period of drying with only one fire per chamber, 1,000 nuts taking 30 hours to dry.

With regard to the erection of demonstration kilns at selected centres, it is strongly recommended that the frequent opening and shutting of doors should be avoided by padlocking the doors. Any inspection of the fires can equally well be effected by means of spyholes suitably arranged, while the copra can be examined by cutting a plank in such a way that a small hinged flap may be opened and the hand inserted into the copra chamber. Water should be sprinkled over any glowing embers before a fresh supply of shells is arranged in the hearth.

APPENDIX II.

Brick Making.

The coastal clay which can be used for brick making in this country must be free from large quantities of organic (peaty) matter. It consists chiefly of hydrated aluminium silicate (the "true clay substance") with more or less sand, and oxide or carbonate of iron and only a small percentage of carbonate of lime. These clays usually burn to a salmon or red colour, and make strong bricks, the strength depending principally on the percentage of hydrated aluminium silicate present. Although the bricks are not required for building purposes and so need not be of great strength, it is necessary to carry out tests on the clays available in any particular district before proceeding with production on a larger scale.

The method of making bricks by hand is the same, with slight variation, all over the world. The top soil is removed until the clay is reached. Water is added to the clay which is well puddled and worked by the feet or poles until it is of a firm plastic consistency. The worked clay, which is made just sufficiently damp to adhere under pressure, is then pressed by hand into a four-sided wooden frame (without top or bottom) which is of the desired shape and size, allowance being made for the shrinkage of the brick in drying and firing. The internal dimensions of the moulds used in recent trials were 8 in. x 4 in. x 3 in.

The moulder stands at his bench, dips the mould in water (or water and then fine sand) to prevent the clay from sticking, takes up a piece of clay of adequate size and dashes it into the mould which is laid flat on the bench.

He then presses the clay into the corners of the mould with his fingers, scrapes off any surplus clay, levels the top by means of a strip of wood, and then turns out the shaped clay on to a board. This board may be provided with a flat, raised projection which will assist in loosening the clay from the sides of the frame.

The bricks can first be laid on the ground to dry in the sun. Subsequently, when sufficient have been prepared, they may be stacked in the form of a low wall one brick thick, in open formation, leaving spaces between each brick for the passage of air. Small *atap* roofs should be available in the event of rain as the bricks may be left for air-drying for as long as a fortnight.

The burning or firing of bricks is the most important factor in their production. since on this the strength and durability of the brick depends. The method of firing bricks in large permanent kilns, employed by the Chinese, is probably the best but the older method of firing in "clamps" is still employed in the smaller brickfields. These clamps are formed by arranging the unfired bricks in the form

of a rectangular stack leaving a space between each brick. Channels are formed in the bottom of the clamp and a fire-hole is arranged in each face of the stack and, in these, fires are kindled. Although clamp firing is slow and irregular, since not all the bricks are equally fired, it is employed wherever bricks are made on a small scale but, so that any cracked and faulty bricks may be discarded, it is recommended that more bricks should be moulded than are actually required. At the same time it is obvious that the firing of any underfired bricks can be completed during their use in the copra kiln.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports by Agricultural Officers.

June, 1936.

The Weather.

Hot and dry weather prevailed throughout the country and the rainfall was below the average for the month at most of the stations from which records are received. Isolated exceptions were the coast around Malacca town and south Johore, Temerloh and Pekan in Pahang, and Kota Bahru in Kelantan, where precipitation was well up to or in excess of the average.

Remarks on Crops.

Padi.—Ploughing proceeded under favourable conditions throughout Kedah, except for Baling District, and some nurseries were established in the Kota Star and Kulim Districts. In Province Wellesley excessive water in some of the deeper areas of the north somewhat delayed the establishment of nurseries. In the newly alienated area at Sungei Acheh, felling and burning made good progress. In Perak, clearing and establishment of nurseries was in progress in the Bagan Serai mukim of Krian and in the north-west of this District. Preparation of the land is nearing completion in Bruas Sub-district and some sowing of nurseries has been done. Transplanting was general in the early areas of Batang Padang District. Irrigation water is available throughout Stage I of the Sungei Manik area and cultivation of the land commenced, whilst further considerable progress was made in the internal bunding of this area. In Stage II, felling is practically completed in the portion occupied by Banjarese, but slow progress was made in the part occupied by planters from Kuala Kangsar. In Selangor, transplanting is well forward in the northern padi areas of Ulu Langat and commenced in the southern part of the District. Felling and clearing continued at Panchang Bedena and further progress was made with bunding between the lots. In Negri Sembilan, transplanting was completed in Jelai mukim of Kuala Pilah District, is well advanced in Jelebu District, and was commenced in Tampin District. In Malacca, transplanting is nearing completion in the earlier areas of Alor Gajah District and ploughing progressed well in the remaining areas and in Central District. In Pahang, transplanting progressed in the down river mukims of Lipis District and throughout Bentong and Temerloh Districts. In Kelantan, ploughing of the dry padi areas is nearing completion and short term wet padi was sown in some localities. In Johore, planting is well advanced in the Endau and Segamat Districts.

Rubber.—There was little change in the price of small-holders' rubber during the month. The increased price for uncouponed rubber in the areas noted last

month was maintained, or showed a slight increase. Reports from Pahang indicate that dealers are generally maintaining the differences of price for various grades which provides for an adequate premium for the better prepared and smoked product, and reports from other parts indicate a general tendency to pay rather better prices than formerly for well-made smoked rubber. In the river mukims of Bruas Sub-district, Perak, eight cabinet smoke houses have been erected recently and reports state that others are in course of erection in various parts of the country.

Copra.—The price of copra appreciated during the month. Prices obtained by owners of approved kilns, whether of the Ceylon type or the newly designed cabinet type, show considerable differences in various parts as compared with the market quotations of Singapore and Penang. In some cases the difference is due to distance from these markets or poor local marketing facilities, but in other instances lower prices obtained are directly connected with lack of attention to detail on the part of the producer. An instance of a satisfactory price resulting from a well-placed position in regard to a ready market, coupled with attention to detail in manufacture, is provided in the report from Krian, Perak, which records that the owner of an approved brick kiln obtained the price of $5.18 a picul for a 70 picul lot of well-prepared copra on a day when the Penang quotation for first grade copra was $5.15 a picul. It is similarly reported that copra from a kiln in Pekan, Pahang, regularly obtains the Singapore price quoted at the time, whereas another kiln at Kuantan produces poorer copra owing to a mixture of unripe nuts amongst those used. In certain instances in Johore failure to obtain good prices is reported to be due to lack of grading of the product before sale. It is obvious that, apart from the provision of satisfactory kilns, much spade work will be needed to induce small-holders to exercise care both in nut selection and in grading the product for market, before small-holders' copra in general will command estate quality price. It is believed that the use of unripe nuts will be a particularly difficult fault to remedy, as the practice of gathering unripe as well as fully ripe nuts is a custom of long standing where nuts are reaped at bi-monthly intervals.

In the Bagan Datoh area all the approved kilns of brick or clay functioned during the month, whilst the erection of further cabinet kilns is reported from Selangor, where one 600 nut kiln was erected at Tanjong Karang, and from Johore, where two further 350 nut kilns were erected and a 1,500 nut kiln is nearing completion.

Agricultural Stations.—In Province Wellesley, on Bukit Mertajam Station, tea pruning was completed and the coffee topped, whilst cuttings of the Kinta variety of tuba were planted in the nursery. On Ayer Itam Station the tea plot was again supplied, half the pineapple plot was planted with Mauritius suckers, and a pig run was completed around one of the sties. At Kuala Kangsar Station in Perak, the tea was tipped and a beginning made with harvesting pepper. Trouble is being experienced from leaf-eating beetles on fruit trees both here and at the Province Wellesley Stations. At Tanah Rata Station, Cameron Highlands, holing

was completed for an extension to the China tea area and strawberry plants were planted. The yield of tea of 15,859 lbs. for the month shows the usual seasonal falling off in yield. A break of tea of 6,066 lbs. was despatched to London for sale. In Selangor, tapioca was planted following *Crotalaria* at Cheras Station, whilst the plant house at Telok Datoh Station was completed. In Negri Sembilan, some sixty marcots of rambutans and pulasans were basketed on the Seremban Fruit Nursery. At Kuala Pilah Station grease banding of coffee, done as a control measure against scale and mealy bugs, has resulted in the death of several plants. The grease, applied on the under side of paper cones tied round the main stems, melted and penetrated the tissues so deeply on several bushes as to kill a cylinder of bark and young wood tissue some 4 to 6 inches long. In consequence of this, all the stems and branches above the grease band died. At Sungei Udang Station in Malacca, the coffee was pruned, a plot of tuba planted, and a number of Pisang Embun added to the banana area, whilst nurseries were sown on the padi area of the Station. In Pahang, at Raub Station, coffee, manila hemp, groundnuts, gingelly and maize were planted. At Temerloh Station a number of annual crops were harvested. At Pekan Station *lalang* grass eradication by contract was completed. In Johore, *lalang* eradication was put in hand at the Pineapple Station, weeding of sporadic *lalang* amongst the cover crop done at the Central Station, whilst roads and drains were demarcated in the nursery area at Tangkak Station and the site for the Agricultural Assistant's quarters was pegged out.

Padi Experiment Stations and Test Plots.—Transplanting was in progress at Kajang Plot in Selangor; at Kendong and Ulu Klawang Plots in Negri Sembilan; at Pekan Station and Kerdau and Bawang Plots in Pahang, and at Tenglu and Jementah Plots in Johore. Nurseries have been sown on all the Kedah Stations and Plots except Pulai. Long-season padi was sown at Titi Serong Station and at the Test Plots in Krian, at Bruas Plot in Perak, Kuang Plot in Selangor, Ampang Tinggi Plot in Negri Sembilan, at Pulu Gadong Station in Malacca, at Lipis and Dong Plots in Pahang, and at Pasir Puteh Station in Kelantan.

Agricultural Show.

The Kedah Agricultural and Livestock Exhibition was held at Alor Star between June 12th and 14th. The Kelantan State Show was held at Peringat on 9th June whilst, in Johore, the Batu Pahat Show was held on the 25th and 26th. Numerous other District and Mukim Shows were held in connexion with the All-Malayan Padi and Rubber Competitions, as preliminaries to either a State Show or to the Thirteenth Malayan Exhibition. It is hoped that a brief description of these and other Shows fixed for the current month will be published in a later issue of this Journal.

DEPARTMENTAL NOTES.

Tours of the Adviser on Agriculture.

The Hon'ble the Acting Director of Agriculture, S.S., and Adviser on Agriculture, Malay States, toured the States of Negri Sembilan and Johore, and the Settlement of Malacca, between the 24th and 27th June. During his tour he inspected Agricultural Stations and Padi Test Plots, and attended the Agricultural Show held at Batu Pahat, Johore, on the 25th June.

Tour of the Rural Lecture Caravan.

The Rural Lecture Caravan toured the Settlement of Malacca from the 10th to 30th June, with a break for attendance at the Batu Pahat Agricultural Show on the 25th and 26th. It also attended the Kuala Kubu Show on 1st June.

Poultry Leaflets.

A new series of leaflets, similar to the Agricultural Leaflets already in circullation, is being prepared on poultry-breeding, and No. 1, The Feeding of Poultry, is now in the press. A supply of copies will be available for distribution at the forthcoming Thirteenth Malayan Exhibition to be held at Kuala Lumpur on the 1st, 2nd and 3rd August.

Leave.

Mr. H. D. Meads, Personal Assistant to the Adviser on Agriculture, has been granted 7 months and 12 days leave on full pay with effect from 20th June, 1936.

Mr. R. G. Heath, Agricultural Officer, Malacca, has been granted 7 months and 2 days leave on full pay with effect from 5th June, 1936.

Mr. G. D. P. Olds returned from leave on the 11th June, and assumed duty as Acting Personal Assistant to the Adviser on Agriculture.

Statistical.

MARKET PRICES.

June, 1936.

Major Crops.

Rubber.—The price of rubber again shewed an upwards tendency during June, the market rising steadily throughout the month. Spot loose opened in Singapore at 25⅜ cents per lb. and closed on a rising market at 26⅜ cents per lb. The average price for the month of No. 1. X. Rubber Smoked Sheet was 25.82 cents per lb. as compared with 25.63 cents in May. The London average price was 7.34 pence per lb., and the New York price 15.76 cents gold, as compared with 7.32 pence and 15.55 cents gold in the previous month.

Prices paid for small-holders' rubber at three centres during June are shewn in the following table.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, June, 1936.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.				Kuala Kangsar, Perak.				Batu Pahat, Johore.			
	4	11	18	25	3	10	17	24	3	10	17	24
Smoked sheet	32.00		32.75		31.63	32.00	32.40	32.70	31.75		31.81	33.00
Unsmoked sheet	31.00	31.31	31.00	32.00				31.50	30.90	31.00	31.10	
Scrap	28.00	28.00	26.00									

Transport by F. M. S. R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent

Palm Oil.—The market continued to fall, but improved at the close, and the following table gives the sterling prices during June for the Malayan commodities.

Table II.
Prices of Palm Oil and Palm Kernels.

Date 1936.	Palm Oil in Bulk, c i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
June 5	15. 10. 0	8. 15. 0
,, 12	15. 0. 0	9. 0. 0
,, 19	15. 0. 0	8. 17. 6
,, 26	16. 5. 0	9. 0. 0

Copra.—Prices improved steadily throughout June with a slight temporary falling off at the close. The sun-dried grade opened in Singapore at $4.85 per picul and rose to $5.30 on the 26th June, closing at $5.10. The average price for the month was $5.00 per picul as compared with $4.77 in May. The mixed quality averaged $4.74 per picul as compared with $4.50 in the previous month.

Copra cake improved to $1.50 per picul, the average for the month being $1.46 per picul as compared with $1.40 in May.

The following comparative London prices of copra are quoted as shewing the position held by Malayan copra in relation to the product of other countries. The prices are per ton, and are averages of the May quotations for the f.m.s. grade: Ceylon £17.0.0., Straits £13.2.0., Java £13.1.6., Philippines £12.9.6., South Seas £12.2.0.

Rice.—The average wholesale prices of rice per picul in Singapore in May were as follows:— Siam No. 2 (ordinary) $3.96, Rangoon No. 1 $3.55, Saigon $3.65, as compared with the April corresponding prices of $3.95, $3.45 and $3.67. May 1935 prices were $4.77, $3.77 and $4.05 respectively.

The average retail market prices in cents per gantang of No. 2 Siam rice in May were:— Singapore 28, Penang 28, Malacca 26, as compared with 28, 28 and 25 respectively in April.

The average declared trade value of imports of rice in May was $3.58 per picul, as compared with $3.66 in April, and $3.56 in March.

Padi.—The price of padi at the Government Rice Mill, Krian, was $1.90 per picul, but the volume of trade was negligible. Retail prices of padi ranged from 6 to 13 cents per gantang in different parts of the Peninsula.

Pineapples.—Singapore prices were raised slightly at the end of the month by the Packers' Combine, and average prices per case for June were: Cubes $3.12, Sliced Flat $3.01, Sliced Tall $3.12, as compared with $3.12, $3.03 and $3.10 respectively in May.

Prices of fresh fruit per 100 were:—Selangor $1.20 to $1.40; Johore 1st quality $1.85 to $2.60, 2nd quality $1.35 to $2, 3rd quality 60 cents to $2.

Beverages.

Tea.—Ten consignments of Malayan tea were sold on the London market during June, one being of upland tea which sold for 1s. 0½d. per lb. The consignments of lowland tea were sold at prices ranging from 11¼d. to 11¾d. per lb.

Average London prices per lb. during June for consignments of tea from other countries were as follows:— Ceylon 1s. 1.14d., Java 10.22d., Indian Northern 1s.0.21d., Indian Southern 1s.0.42d., Sumatra 10.02d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report,* 22nd June, 1936, of the Colombo Brokers' Association, and are as follows (rupee cents per lb.):— High Grown Teas 69 cents, Medium Grown Teas 61 cents, Low Grown Teas 59 cents.

Coffee.—The price of Sourabaya coffee in Singapore during June fell sligtly, averaging $12.94 to $13.94 per picul according to quality. Palembang coffee averaged $7.37 to $8.37 per picul as compared with $7 to $7.94 in May.

Prices of locally grown coffee varied considerably according to districts, and ranged from $8 to $30 per picul.

Spices.

Arecanuts.—Prices in Singapore improved during June; averages per picul were Splits $4.81 to $6.69; Red Whole $5.44 to $6.56; Sliced $7.87 to $9.31.

The Singapore Chamber of Commerce prices rose considerably early in the month, and averages per picul were: Best $6.76, Medium $6.38, Mixed $5.18, as compared with $6.35, $5.90 and $4.49 respectively in May.

Pepper.—Nominal prices were further marked down in Singapore at the close of the month. The averages of the quotations per picul were: Singapore Black $8, Singapore White $15.75, Muntok White $16.25.

Nutmegs.—Prices in Singapore remained unchanged throughout the month at $28 and $29 per picul respectively for 110's and 80's, as compared with $27.50 and $28.50 in May.

Mace.—The Singapore market weakened and average prices per picul for June were:— Siouw $86.25, Amboina $71.25, as compared with $90 and $75 respectively in May.

Cloves.—Nominal quotations for Zanzibar and Amboina continued unchanged at $38 per picul.

Cardamoms.—Green cardamoms were quoted in the Ceylon Chamber of Commerce reports at Rs.1.50 to Rs. 1.60 rising to Rs. 1.60 to Rs. 1.75 at the close.

Miscellaneous.

Tuba Root (*Derris*).—Further falling off of demand, especially for rotenone-yielding roots, brounght about slightly lower prices, and the Singapore market was dull throughout the month. The average price per picul for June for roots sold on rotenone content was $50, and $34 for roots sold on a basis of ether extract. The May average prices were $51 and $34 respectively.

Gambier.—The Singapore market weakened still further at the close of June, and average prices per picul were Block $5.19, No. 1 Cube $10.38, as compared with $5.55 and $10.50 in the previous month.

Tapioca.—Singapore prices still continued unchanged at: Flake, Fair $5.40, Seed Pearl $5.50, Medium Pearl $6.50.

Sago.—Pearl, Small Fair, weakened slightly at the close to average $3.89 per picul, and Flour, Sarawak Fair, averaged $2.25 per picul, as compared with $3.90 and $2.26 respectively in May.

Tobacco.—In one District of Selangor prices of locally grown tobacco were high, being $100 per picul for 2nd quality, and $75 for 3rd quality. In Kelantan also, prices were high, the range being 1st quality $80, 2nd quality $70 to $85, 3rd quality $62.50 per picul. The range in other parts of the country was: 1st quality $20 to $31.50, 2nd quality $15 to $30, 3rd quality $10 to $16 per picul.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Kohyei & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross. London, S.W.1.

GENERAL RICE SUMMARY*

May, 1936.

Malaya.—Imports of foreign rice during May were 58,161 tons, and exports 12,874 tons. Net imports for the first five months of the year totalled 211,314 tons, as compared with 186,374 tons in 1935, an increase of 13.4 per cent.†

Of the imports during May, 47 per cent. were consigned to Singapore, 17 per cent. to Penang, 9 per cent. to Malacca, 21 per cent. to the Federated Malay States and 6 per cent. to the Unfederated Malay States. Of the total, 65.4 per cent. came from Siam, 28.8 per cent. from Burma, 4.8 per cent. from Indo-China, and 1 per cent. from other countries.

Of the May exports, 74 per cent. were consigned to the Netherlands Indies, and 26 per cent. to other countries. The various kinds of rice exported were as follows (in tons, percentages in brackets):—Siam 9,513 (73.9), Burma 2,541 (19.7), French Indo-China 580 (4.5), parboiled 176 (1.4), local production 64 (0.5).

India and Burma.—Foreign exports during January to April totalled 553,000 tons, as compared with 774,000 tons in 1935, a decrease of 28.6 per cent. Of these exports 4.3 per cent. were to the United Kingdom, 21.2 per cent. to the Continent of Europe, 25.7 per cent. to Ceylon, 19.0 per cent. to the Straits Settlements and the Far East, and 29.8 per cent. to other countries. The corresponding 1935 percentages were 4.8, 10.5, 19.8, 34.7 and 30.2.

Siam.—Exports of rice and rice products from Bangkok during April are provisionally given as 152,019 tons, the cumulative total for the year being 546,583 tons as compared with 588,632 tons in 1935.

Japan.—Estimated demand and supply for the six months May to October inclusive are as follows:—

				tons
Supply:	Stocks on 1 May 1936		...	4,892,992
	Imports of Korean rice		...	462,833
	Imports of Formosan rice		...	434,783
		Total	...	5,790,608
Demand:	Consumption		...	4,516,134
	Exports		...	37,868
				4,554,002

* Abridged from the Rice Summary for May, 1936, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935.

Stocks:	Between-season 31st October 1936 Government-owned rice	...	897,616
	Privately-owned rice	...	338,990
			1,236,606

French Indo-China.—Entries of padi into Cholon during the first five months of 1936 totalled 778,824 metric tons, a decrease of 21 per cent. as compared with 985,554 metric tons in 1935. Exports for the same period decreased by 22.5 per cent. from 1,031,961 metric tons in 1935 to 799,417 metric tons in 1935.

Netherlands Indies.—The latest information available was published in the February Summary.

Ceylon.—Imports during January to May totalled 224,456 tons, as compared with 220,373 tons in 1935, an increase of 1.9 per cent. Of these imports 12.6 per cent. were from British India, 62.9 per cent. from Burma, 0.2 per cent. from the Straits Settlements, and 24.3 per cent. from other countries. The corresponding 1935 percentages were 11.5, 70.5, 1.4 and 16.6.

Europe and America.—Shipments from the East to Europe during the period 1st January to 7th May totalled 431,537 tons as compared with 361,532 tons in 1935, an increase of 19.4 per cent. Of these shipments, 44.4 per cent. were from Burma, nil from Japan, 45 per cent. from Saigon, 8.7 per cent. from Siam, and 1.9 per cent. from Bengal. The corresponding 1935 percentages were 67.5, 2.1, 23.2, 4.5 and 2.7.

Shipments for the Levant from the 1st January to 6th May were 6,327 tons, a decrease of 67.4 per cent. when compared with the 1935 shipments of 19,428 tons. Shipments for Cuba, West Indies and America from the 1st January to 8th May totalled 83,425 tons as compared with 99,277 tons in 1935, a decrease of 16 per cent.

MALAYAN AGRICULTURAL EXPORTS, MAY, 1936.

PRODUCT.	Net Exports in Tons				
	Year 1935	Jan.-May 1935	Jan.-May 1936	May 1935	May 1936
Arecanuts ...	21,588	10,110	12,228	1,860	1,577
Coconuts fresh † ...	106,272†	39,093†	44,614†	7,169†	6,842†
Coconut oil ...	35,911	12,504	18,547	2,705	4,163
Copra ...	111,752	42,814	26,548	3,734	5,107
Gambier, all kinds ...	2,837	1,139	897	208	135
Oil cakes ...	11,361	3,246	5,326	555	1,298
Palm kernels ...	3,892	1,381	1,662	310	369
Palm oil ...	24,598	8,677	8,664	1,585	1,059
Pineapples canned ...	73,923	29,284	32,168	8,795	9,891
Rubber ¶ ...	378,381¶	164,398¶	138,637¶	32,930¶	26,331¶
Sago,—flour ...	10,920	4,778	3,082	183	1,632
,, —pearl ...	4,655	1,837	1,368	351	367
,, —raw ...	7,735*	2,766*	3,590*	639*	845*
Tapioca,—flake ...	1,953	848	820	266	133
,, —flour ...	755*	461*	833*	156*	203*
,, —pearl ...	17,169	6,553	6,084	1,703	1,082
Tuba root ...	567	256½	308	79½	62

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION (IN TONS) OF PALM OIL AND KERNELS

(As declared by Estates)

Month 1936	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S
January ...	1,395.4	326.5	258.6	37.2
February ...	1,531.9	372.4	244.2	54.6
March ...	1,878.4	534.5	302.9	88.0
April ...	1,410.6	446.8	250.0	80.0
May ...	1,346.1	644.8	238.1	114.6
Total ...	7,562.4	2,325.0	1,293.8	374.4
Total January to May 1935 ...	5,229.3	1,684.2	818.1	240.2
Total for year 1935 ...	17,338.7	5,764.6	2,711.1	818.4

MALAYAN RUBBER STATISTICS

Acreages of Tappable Rubber not Tapped on Estates of 100 Acres and over, for the Month ending 31st May, 1936.

State or Territory	Acreage of Tappable Rubber end 1935	Estates which have entirely ceased tapping		Estates which have partly ceased tapping (a)		Area of Tappable Rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Straits Settlements :—									
Province Wellesley	44,526	562	1.3	16,922	38.0	672	1.5	17,484	39.3
Malacca	121,601	4,931	4.1	33,821	27.8	2,928	2.4	38,752	31.9
Penang Island	2,575	Nil	Nil	569	22.1	283	11.0	569	22.1
Singapore Island	34,525	4,537	13.1	9,235	26.8	394	1.0	13,772	39.9
Total S.S. ...	203,227	10,030	4.9	60,547	29.8	4,277	2.1	70,577	34.7
Federated Malay States :—									
Perak	294,988	12,412	4.2	73,655	25.0	14,497	4.9	86,067	29.2
Selangor	332,165	12,222	3.7	74,357	22.4	16,827	5.1	86,579	26.1
Negri Sembilan	258,304	16,996	6.6	54,900	21.2	16,992	6.6	71,896	27.8
Pahang	77,210	10,822	14.0	28,085	36.4	18,215	23.6	38,907	50.4
Total F.M.S. ...	962,667	52,452	5.4	230,997	24.0	66,531	6.9	283,449	29.4
Unfederated Malay States :—									
Johore	432,443	35,455	8.2	68,365	15.8	39,792	9.2	103,820	24.0
Kedah	199,607	3,880	2.0	22,423	11.2	19,349	9.7	26,303	13.2
Kelantan	30,474	403	1.3	10,470	34.4	5,330	17.5	10,873	35.7
Trengganu (b)	4,643	Nil	Nil	15	0.3	179	3.9	15	0.3
Perlis (c)	1,575	Nil	Nil	653	41.5	59	3.7	653	41.5
Brunei	6,010	Nil	Nil	1,683	28.0	893	14.9	1,683	28.0
Total U.M.S. ...	674,752	39,738	5.9	103,609	15.3	65,602	9.7	143,347	21.2
Total Malaya ...	1,840,646	102,220	5.5	395,153	21.5	136,410	7.4	497,373	27.0

Notes :—(a) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(b) Registered Companies only.
(c) Rendered quarterly.

MALAYAN RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF MAY, 1936, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January to May 1936		during the month		January to May 1936						
	Ports	Dealers	Estates of 100 acres and over	during the month	January to May 1936	during the month	January to May 1936	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to May 1936
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	7,983	10,834	9,441	47,292	4,199	28,786	Nil	Nil	Nil	Nil	12,015	2,270	55,080	16,322	...	7,091	11,072	9	37
Johore ...	..	2,565	4,024	3,863	19,528	2,282	14,279	Nil	108	Nil	299	2,814	3,749	10,749	22,932	...	2,295	3,984	...	...
Kedah ...	...	337	2,652	2,421	12,370	635	3,108	Nil	Nil	Nil	Nil	1,795	1,378	6,901	9,270	...	351	2,521	...	...
Perlis ...	...	14	19	10	55	11	93	Nil	Nil	Nil	Nil	Nil	30	Nil	148	...	7	17	...	...
Kelantan ...	...	259	232	268	1,344	476	2,564	Nil	Nil	Nil	Nil	126	592	749	3,193	...	254	263	...	...
Trengganu ...	...	55	50	236	1,069	118	535	Nil	Nil	Nil	Nil	Nil	354	Nil	1,604	...	55	50	...	...
Brunei ...	...	8	24	38	199	47	285	...	...	...	...	...	67	...	487	...	13	37	...	...
Total Malay States	...	11,221	17,835	16,277	81,857	7,768	44,650	Nil	108	Nil	299	16,750	8,440	73,479	53,956	...	10,066	17,944	9	37
S. SETTLEMENTS :—																				
Malacca ...	...	2,069	1,187	945	4,875	478	2,645	Nil		Nil		2,505		11,088		...	2,319	1,167	...	...
Province Wellesley	...	1,036	527	401	1,923	167	988	Nil		Nil		5,830		35,284		...	947	532	...	...
Penang ...	1,035	5,299	8	18	82	50	334	2,044	10,006	12,191	53,730		Nil		Nil	1,357	4,805	11	...	...
Singapore ...	4,127	21,739	191	141	719	72	490	10,413		58,119		21,483		87,057		3,083	17,442	176	23	107
Labuan ...	...	16	Nil	Nil	Nil	14	74	70		384		Nil		Nil		...	17	Nil	...	...
Total Straits Settlements ...	5,162	30,159	1,913	1,505	7,599	781	4,531	12,527	10,006	70,694	53,730	29,818	Nil	133,429	Nil	4,440	25,530	1,886	23	107
Total Malaya ...	5,162	41,380	19,748	17,782	89,456	8,549	49,181	12,527	10,114	70,694	54,029	46,568	8,440	206,908	53,956	4,440	35,596	19,830	32	144

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	6,106	16,792	4,521	2,834	2,001	169
WET RUBBER	985	650	284	462	294	182
TOTAL ...	7,091	17,442	4,805	3,296	2,295	351

TABLE III
FOREIGN EXPORTS

PORTS 29	For month 30	January to May 1936 31
Singapore ...	31,507	131,259
Penang ...	9,677	51,104
Port Swettenham.	5,116	23,327
Malacca ...	268	1,218
MALAYA ...	46,568	206,908

TABLE IV
DOMESTIC EXPORTS 4

AREA 32	For month 33	January to May 1936 34
Malay States ...	25,190	127,435
Straits Settlements	1,909	11,230
MALAYA ...	27,099	138,665

Notes:—
1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 24th June, 1936.

METEOROLOGICAL SUMMARY, MALAYA, MAY, 1936.

Locality.	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B.	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total.	Total.	Most in a day. Amt.	Number of days: Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total.	Daily Mean.	Per cent.
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	91.2	73.3	82.3	95	69	86	78	84.7	85.5	14.49	368.1	2.27	19	17	7	4		177.55	5.73	47
Bukit Jeram, Selangor ...	88.4	73.6	81.0	91	71	81	77	84.4	86.7	11.27	286.3	3.95	15	13	2	2	3	213.20	6.88	56
Sitiawan, Perak ...	89.1	74.3	81.7	92	70	81	77	84.8	85.2	5.97	151.7	1.30	14	12	1			198.10	6.39	52
Temerloh, Pahang ...	89.8	73.7	81.7	93	68	86	77	86.3	86.5	11.29	286.8	2.32	19	19	2	5		180.00	5.81	47
Kuala Lipis, Pahang ...	89.6	72.6	81.1	92	68	85	76	85.0	85.3	10.75	273.1	2.50	19	17	2	14	1	168.75	5.44	44
Kuala Pahang, Pahang ...	87.2	75.0	81.1	90	73	82	77	86.0	86.6	5.65	143.5	1.28	17	14				201.75	6.51	53
Kallang Aerodrome, S'pore ...	86.8	77.2	82.0	90	74	82	82	83.1	84.1	10.34	262.6	2.08	17	13	5			182.30	5.88	48
Butterworth, Province Wellesley ...	88.5	75.3	81.9	92	73	81	79	86.4	86.8	11.73	297.9	3.91	20	16				209.65	6.76	55
Bayan Lepas Aerodrome Penang ...	87.9	75.3	81.6	91	73	82	78	85.1	85.6	9.64	244.9	2.17	19	17	2			197.35	6.37	52
Bukit China, Malacca ...	85.7	74.9	80.3	89	72	82	77	84.4	85.3	8.79	223.3	2.58	22	17	3		2	193.65	6.25	51
Kluang, Johore ...	88.5	72.6	80.5	92	70	76	76	83.1	83.1	10.79	274.1	2.20	18	17	3	12		172.20	5.55	45
Bukit Lalang, Mersing, Johore	86.5	73.1	79.8	92	71	78	75	82.7	82.1	8.48	215.4	2.07	13	12	3	1		201.40	6.50	53
Alor Star, Kedah ...	88.7	75.8	82.3	93	73	80	78	87.3	87.0	9.93	252.2	3.33	19	15	1	2		200.60	6.47	52
Kota Bahru, Kelantan ...	89.8	74.9	82.3	94	72	86	78	85.1	85.1	7.74	196.6	2.61	11	10	3		1	219.10	7.07	57
Kuala Trengganu, Trengganu	88.5	74.4	81.5	91	72	83	77	84.2	85.0	8.83	224.3	3.98	14	11	2			216.65	6.99	57
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	75.7	63.6	69.7	79	60	71	66	73.2	73.2	11.62	295.2	2.05	22	21	1	13		154.10	4.97	40
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	74.1	57.8	65.9	78	48	67	63	71.0	70.8	11.93	303.0	2.42	21	18	1	4	2	144.30	4.65	38
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	72.3	60.7	66.5	77	58	66	63			12.67	321.8	2.49	21	18	1	4	2	151.00	4.87	39

Compiled from Returns supplied by the Meteorological Branch, Malaya

Kuala Kurau Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Bagan Serai Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Briah Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Selinsing Padi Test Station, *Agricultural Officer, Parit Buntar.*
Bukit Gantang Padi Test Station, *State Agricultural Officer, Perak, Taiping.*
Lenggong Padi Test Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*
Bruas Padi Test Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*
Sungei Manik Padi Test Station, *Agricultural Officer, Perak South, Teluk Anson.*
Panchang Bedena Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Sungei Haji Durani Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Tanjong Karang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kuang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kajang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kuala Klawang Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
Ampang Tinggi Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
Kendong Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
Dong Padi Test Station, *State Agricultural Officer, Pahang, Raub.*
Kuala Lipis Padi Test Station, *State Agricultural Officer, Pahang, Raub.*
Kerdau Padi Test Station, *Malay Agricultural Officer, Pahang South, Temerloh.*
Bawang Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
Pekan Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
Sungei Blat Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
Glugor Padi Test Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*
Bukit Merah Padi Test Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Unfederated Malay States.

Central Experiment Station, Ayer Hitam, Johore, *Agricultural Officer, Johore Central, Kluang.*
Tangkah Agricultural Station, *Agricultural Officer, Johore North, Muar.*
Gaja Mati Agricultural Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Central Experiment Station, Kota Bharu, Kelantan, *State Agricultural Officer, Kelantan, Kota Bharu.*
Kilanas Agricultural Station and Padi Test Station, Brunei, *Agricultural Officer, Singapore.*
Tangkah Padi Test Station, *Agricultural Officer, Johore North, Muar.*
Jimentah Padi Test Station, *Agricultural Officer, Johore North, Muar.*
Tenglu Padi Test Station, *Agricultural Officer, Johore Central, Kluang.*
Telok Chengai Padi Experiment Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Langgar Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Jitra Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Rantau Panjang Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Pulai Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Sala Kanan Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Pasir Puteh Padi Test Station, *State Agricultural Officer, Kelantan, Kota Bharu.*
Seriab Padi Test Station, *Adviser, Perlis, Kangar.*
Kampong Salang Padi Test Station, *Adviser, Perlis, Kangar.*
Lumapas Padi Test Station, Brunei, *Agricultural Officer, Singapore.*


REPLANTING?
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THE

Malayan Agricultural Journal.

AUGUST, 1936.

EDITORIAL.

Padi Soils

Accounts have appeared in previous issues of this Journal of examinations of padi soils, and in this number we print

... of the problem is essentially an agricultural one, and the reader is referred to an article which appeared in the *Malayan Agricultural Journal* for June 1935, in which were described experiments, carried out to throw some light on the extent to which the yield of root of different species of Derris might be affected by artificial fertilizers.

A prominent fact which emerges from the increasing attention which is being devoted to Derris or "tuba" is the need for a thorough investigation into the classification of the members of this genus. In an article by Mr. J. N. Milsum, Acting Agriculturist, entitled "Derris Cultivation in Perak", which we reproduce in this number, a description is given of the cultivation in Perak of a type of plant which is considered by the author of the article to be referable to *Derris malaccensis*, but which, on more detailed examination may prove to be a distinct species. Roots of this type have been analysed and have been found to contain a moderately high percentage of ether extract and a very low percentage of rotenone. These are characteristics of *Derris malaccensis* Prain var. *sarawakensis* Henderson, but the Perak type, to which the author refers as the "Kinta type", differs in habit from *D. malaccensis* var. *sarawakensis*. These observations again point to the complexity of the classification of this genus of useful plants.

Carpet Grass. The investigations described in the article by Major C. D. V. Georgi, Agricultural Chemist, into the chemical composition of carpet grass grown at the Central Experiment Station, Serdang, owe their origin to the fact that carpet grass is not greatly relished by cattle. The results of the investigations show that the lesser palatability of carpet grass may be due to the fact that the grass has a lower crude protein content and lower moisture content during dry weather than the more relished guinea grass.

Original Articles.

THE LOSS OF PHOSHATES AND AMMONIA FROM PADI SOILS KEPT IN THE LABORATORY UNDER ANAEROBIC CONDITIONS

BY

J. H. DENNETT,

Soils Chemist.

Reference has been made in the annual reports of the Division of Soils and Plant Physiology for 1934 and 1935 to the losses of nitrogen and phosphates from padi soils under anaerobic conditions.

Below are given the results of observations, made in the laboratory over a period of nine months, on two padi soils kept under water. Each of these soils had a series of varying quantities of ammonium sulphate and superphosphate added to them and the amount of these substances lost each week was recorded.

Two kilograms of soil from the Test Station at Selinsing, Perak, were placed in each of fourteen winchester quart bottles and to these were added superphosphate and ammonium sulphate each at the following rates per acre:—

Control, 2 cwt., 5 cwt., 10 cwt., 20 cwt., 30 cwt., and 40 cwt.; in all seven lots, each in duplicate. Selinsing is a normal-yielding soil; in terms of padi, capable of yielding about 400 gantangs per acre.

A similar series was prepared with a soil, from Balik Pulau, Penang Island, capable of yielding 1,000 gantangs.

The soils were covered with tap water to a depth of about two inches and samples of 300 cc.* were removed daily. These were bulked and the phosphate and ammonia content estimated at weekly intervals.

Ammonia Losses.

The results of the grand total of ammonia are shewn graphically to demonstrate the increases in ammonia lost with increases in quantities added, and also to illustrate the larger losses obtained with the richer soil, suggesting that loss and immediate availability are possibly closely related.

In the tables are shewn actual amounts, in grams, of ammonia added (as sulphate) and monthly amounts lost in milligrams.

It is to be noted that the loss from the Selinsing soil without any added ammonia is at the rate of 1½ cwt. ammonium sulphate per acre † over the nine months, while in the case of the Penang soil this loss on the control is rather over 3 cwt. Where manures are added the loss with 2 cwt. is much the same as the control, rising with the heavier dressings to between 20 and 25 per cent. of the amount added in the case of Selinsing and 25 and 30 per cent. in the case of Penang soil.

* A quantity proportional to the general flow rate for irrigated padi. (1 cu. foot of water per 50 acres per second).

† Using the conventional conversion factor of 1,000,000 kilograms per acre-foot = approximately 1,000 tons.

The table gives the mean figures. The duplicates only differ from the mean by about 5 per cent.

Loss of Phosphates.

A study of the loss of phosphates shews a rather different position. For the control in the case of Selinsing the loss is only at the rate of about 18 lbs. of superphosphate per acre over the nine months and in the case of Penang about 75 lbs. At the maximum dressing of 40 cwt. the losses are respectively 40 lbs. and 230 lbs.

The figures in the table again represent means of the duplicates but here the accuracy of the means is not so great, variations occasionally being as much as 50 per cent. of the mean.

From the graphs it will be seen that nearly all of the superphosphate is adsorbed in the case of Selinsing soil and that even in the case of Penang soil, although the loss is five or six times as much, the tendency towards increased losses with heavier dressings is comparatively small, a point which has a bearing on the results described elsewhere in the *Malayan Agricultural Journal* * in connexion with pot padi experiments.

Monthly Decreases in Losses.

(a) Ammonia.

An interesting point is the gradual decreases in the losses from month to month, so that at the end of nine months there is a tendency for all losses to become the same, irrespective of the amount of manure added or the type of soil concerned.

The tables and the graphs apply to soils which were not aerated; it was found that if aerated water was continuously supplied and run off, the losses of ammonia decreased more rapidly and that at the end of four months nitrates might be present in the run-off water.

(b) Phosphate.

In this case the maximum loss was found at the end of the second month, and although there is a tendency for losses to decrease, the decrease is at a much smaller rate than for ammonia and there is some tendency for losses to be periodic.

It appears probable that there is a gradual decrease in available nitrogen as ammonia throughout a growing season, while the available phosphate is possibly more evenly distributed. Further, it seems likely, in view of the tendency for ammonia losses to become equal irrespective of the amount of manure added, that there is considerable loss of nitrogen as nitrogen gas.

Finally it must be remembered that the conditions are not the same as field conditions of growing padi, this investigation being an attempt to get at the order of possible losses without the complication of the plant factor. In point of fact, much of the "losses" here shown may not occur under growing padi but it seems not unlikely that these losses are representative of amounts available to the plant.

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* Vol. XXIV, July, 1936. p. 309 *et seq.*

Table I.
Ammonia in Leachings.
1935.

	Soil	March mg.	April mg.	May mg.	June mg.	July mg.	August mg.	Sept. mg.	Oct. mg.	Nov. mg.	Grand Total mg.
	Selinsing Soil										
1.	Control.	1.44	4.09	2.92	2.60	3.02	1.59	1.96	1.26	1.14	19.52
2.	0.163 gms. ammonium sulphate 0.163 „ superphosphate = 2 cwt.	3.58	5.52	3.52	2.92	3.14	1.00	0.84	—	0.86	21.38
3.	0.407 „ ammonium sulphate 0.407 „ superphosphate = 5 cwt.	8.59	6.67	6.18	3.64	4.16	3.00	3.58	1.84	0.84	37.58
4.	0.815 „ ammonium sulphate 0.815 „ superphosphate = 10 cwt.	16.16	15.62	5.28	3.52	2.92	1.68	1.94	1.12	1.16	49.40
5.	1.63 „ ammonium sulphate 1.63 „ superphosphate = 20 cwt.	33.14	32.04	7.72	6.36	4.52	3.35	2.51	—	0.76	91.95
6.	2.45 „ ammonium sulphate 2.45 „ superphosphate = 30 cwt.	48.76	33.86	12.12	9.40	5.66	3.65	3.93	—	0.76	118.16
7.	3.26 „ ammonium sulphate 3.26 „ superphosphate = 40 cwt.	62.98	45.24	15.36	14.65	8.92	5.40	5.10	1.84	1.14	159.71

Table I (*Cont.*)
Ammonia in Leachings.
1935.

	Soil	March mg.	April mg.	May mg.	June mg.	July mg.	August mg.	Sept. mg.	Oct. mg.	Nov. mg.	Grand Total mg.
	Penang Soil										
1.	Control.	8.98	11.64	6.06	7.44	8.76	2.64	3.72	1.96	1.14	51.02
2.	0.163 gms. ammonium sulphate = 2 cwt. 0.163 " superphosphate	10.65	13.68	8.40	7.48	4.49	1.58	1.68	0.64	0.40	48.98
3.	0.407 " ammonium sulphate = 5 cwt. 0.407 " superphosphate	18.96	19.32	10.96	6.36	3.72	—	0.72	—	0.20	60.16
4.	0.815 . ammonium sulphate = 10 cwt. 0.815 " superphosphate	26.52	19.62	10.80	9.00	7.18	—	1.08	—	0.28	74.60
5.	1.63 " ammonium sulphate = 20 cwt. 1.63 " superphosphate	43.43	39.00	15.40	11.56	9.60	0.20	1.56	1.84	0.76	122.75
6.	2.45 " ammonium sulphate = 30 cwt. 2.45 " superphosphate	50.00	43.10	23.28	7.40	2.60	0.80	1.56	1.96	0.66	131.39
7.	3.26 " ammonium sulphate = 40 cwt. 3.26 " superphosphate	88.02	61.80	21.34	14.73	9.62	1.22	1.80	1.40	1.52	201.55

Table II.
P_2O_5 in Leachings.
1935.

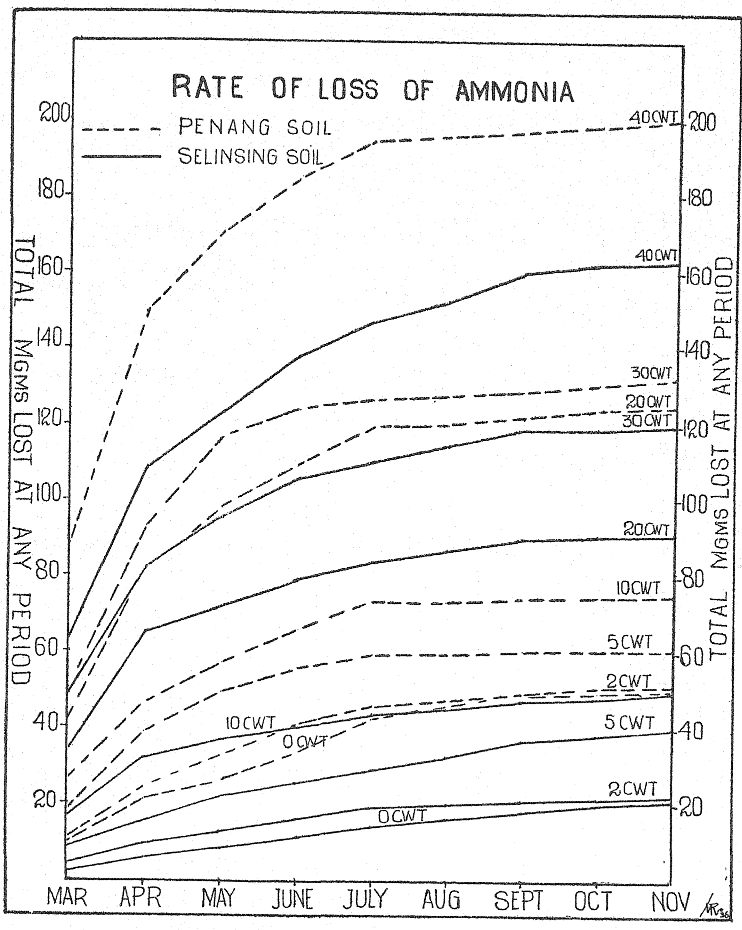
	Soil	March mg.	April mg.	May mg.	June mg.	July mg.	August mg.	Sept. mg.	Oct. mg.	Nov. mg.	Grand Total mg.
	Selinsing Soil										
1.	Control.	0.425	0.516	0.396	0.131	0.200	0.198	0.511	0.232	0.110	2.768
2.	0.163 gms. ammonium sulphate = 2 cwt. 0.163 „ superphosphate	0.222	0.276	0.310	0.112	0.175	0.078	0.318	2.590	0.099	4.180
3.	0.407 „ ammonium sulphate = 5 cwt. 0.407 „ superphosphate	0.290	0.295	0.223	0.107	0.176	0.068	0.336	10.168	0.142	11.806
4.	0.815 „ ammonium sulphate = 10 cwt. 0.815 „ superphosphate	0.326	0.228	0.324	0.120	0.170	0.069	0.334	1.523	1.122	4.217
5.	1.63 „ ammonium sulphate = 20 cwt. 1.63 „ superphosphate	0.232	0.146	0.553	0.127	0.323	0.066	0.210	0.654	0.999	3.315
6.	2.45 „ ammonium sulphate = 30 cwt. 2.45 „ superphosphate	0.361	0.187	0.413	0.170	0.652	0.054	0.285	1.794	2.104	6.022
7.	3.26 „ ammonium sulphate = 40 cwt. 3.26 „ superphosphate	0.449	0.395	0.384	0.200	1.130	0.105	0.214	2.491	1.250	6.022

Table II *(Cont.)*

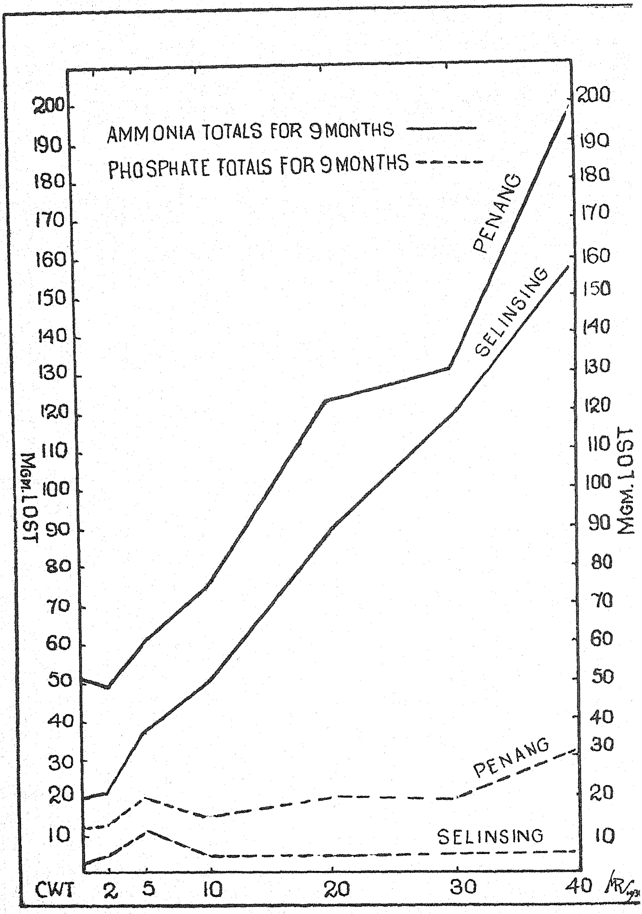
P_2O_5 in Leachings.

1935.

	Soil	March mg.	April mg.	May mg.	June mg.	July mg.	August mg.	Sept. mg.	Oct. mg.	Nov. mg.	Grand Total mg.
	Penang Soil										
1.	Control.	1.193	3.103	0.837	0.513	0.412	0.198	3.523	1.482	0.300	11.562
2.	0.163 gms. ammonium sulphate 0.163 „ superphosphate = 2 cwt.	2.372	4.099	0.755	0.335	0.483	0.570	2.001	1.480	0.505	12.601
3.	0.407 „ ammonium sulphate 0.407 „ superphosphate = 5 cwt.	3.337	4.941	2.062	0.763	1.267	0.880	1.986	2.383	2.507	20.069
4.	0.815 „ ammonium sulphate 0.815 „ superphosphate = 10 cwt.	2.152	3.799	1.202	0.533	1.247	0.578	1.952	1.268	1.959	14.641
5.	1.63 „ ammonium sulphate 1.63 „ superphosphate = 20 cwt.	4.007	6.207	1.300	0.506	1.865	0.334	3.274	2.812	0.267	20.123
6.	2.45 „ ammonium sulphate 2.45 „ superphosphate = 30 cwt.	5.261	4.968	1.669	0.609	1.316	0.522	2.307	1.515	1.409	19.576
7.	3.26 „ ammonium sulphate 3.26 „ superphosphate = 40 cwt.	4.956	9.482	3.919	1.412	3.343	1.796	1.438	5.403	1.498	32.731


RATE OF LOSS OF AMMONIA
PENANG SOIL
SELINSING SOIL
TOTAL MGMS LOST AT ANY PERIOD
200
180
160
140
120
100
80
60
40
20
40 CWT
30 CWT
20 CWT
10 CWT
5 CWT
2 CWT
0 CWT
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV

Total Losses of Ammonia and Phosphate.



PRELIMINARY SELECTION EXPERIMENTS WITH DERRIS

BY
C. D. V. GEORGI,
Agricultural Chemist,
J. LAMBOURNE,
Assistant Agriculturist
and
GUNN LAY TEIK,
Assistant Analyst.

Introductory.

One of the more urgent problems confronting the Derris industry at present is the necessity for a close study of the different species with a view to developing types with a high toxic content. At present the toxicity of a commercial consignment of the root is judged either by the rotenone content and/or the ether extract.

The variability in quality of consignments has been one of the principal reasons adversely affecting the development of Derris as an insecticide and, now that growing competition from a similar product—cubé root (*Lonchocarpus* sp.)—must be met, the necessity for standardizing high-grade Derris becomes of greater importance.

A comprehensive survey of the principal species now being grown in Malaya has therefore been undertaken to determine the variations in toxic content as shown by chemical analysis between roots of individual plants. Further, cuttings from plants of superior toxic content have been established to ascertain the degree to which this quality can be reproduced in successive generations of the original plants, and to ensure as far as possible the isolation of clonal types of each desirable species.

List of Species Examined.

The species of Derris examined included the following:—

(a) *Derris malaccensis* var. *sarawakensis.*
(b) *Derris elliptica,* Sarawak creeping.
(c) *Derris elliptica* (Serdang type).
(d) *Derris polyantha*?*.
(e) *Derris elliptica* (Singapore type).
(f) *Derris malaccensis* (Kinta type).

An account of the experimental work carried out with each species will now be given.

Outline of Experimental Work.

(a) *Derris malaccensis* var. *sarawakensis.*

Forty plants, aged between 24 and 25 months, were selected at random in a plot at the Central Experiment Station, Serdang. The stems of each plant were

* The botanical identification of this species must be regarded as doubtful.

removed and reserved for the purpose of striking cuttings, while the whole of the root system of each plant was lifted.

The roots were washed free from adhering soil, dried and the "fine" or marketable roots separated. The weights of the air-dry roots were recorded in each case.

Analysis was restricted to a determination of the ether extract. Subsequently, rotenone estimations were carried out on four samples selected at random to obtain an indication of the extent of the variation existing between rotenone and ether extract for this species.

The weights of marketable roots for the individual plants, calculated on a moisture-free basis, varied from 7.79 to 1.14 ozs. with an average of 3.89 ozs.

The figures for ether extract, calculated on a moisture-free basis, varied from 25.65 to 6.13 per cent., the average figure being 19.44 per cent.

Table I, in which the figures are divided into groups of 1 per cent., affords a better indication of the frequency of variation.

Table I.

Species - *Derris malaccensis* var. *sarawakensis*.

Ether Extract of Marketable Roots from Individual Plants at Serdang arranged in Groups of 1 per cent.

Ether Extract (moisture-free basis)	No. of Samples.
per cent.	
26 — 25	1
25 — 24	—
24 — 23	2
23 — 22	6
22 — 21	8
21 — 20	7
20 — 19	4
19 — 18	4
18 — 17	1
17 — 16	2
16 — 15	—
15 — 14	1
14 — 13	1
Below 13	3
	Total 40

Excluding the figures in the 20 to 19 group, which will include the average figure of 19.44 per cent. for all the plants, the results indicate that there are 24 plants in which the ether extract of the root system is above the average, and 12 plants in which it is below the average.

The results of the rotenone determinations, which are summarized in Table II, indicate that for this species of Derris the proportion of rotenone to ether extract is approximately 15 per cent.

Table II.

Relationship between Rotenone Content and Ether Extract for Roots of *Derris malaccensis* var. *sarawakensis*.

Serial No. of Plant	Rotenone (moisture-free basis)	Ether Extract (moisture-free basis)	Proportion of Rotenone to Ether Extract
	per cent.	per cent.	per cent.
5	2.73	21.07	13.0
9	4.29	25.65	16.7
19	3.26	21.89	14.9
22	3.04	21.40	14.2
		Average	14.7

In the selection of planting material with a view to the cultivation of the crop under estate conditions, a factor of equal if not greater importance than the toxic content is the yield of marketable root per plant. Thus, in the case of root being sold on a basis of ether extract, a plant yielding 8 ozs. of root with an ether extract of 18 per cent. is more valuable than one yielding 4 ozs. of root in which the ether extract may amount to 24 per cent. In the former case the toxicity of the root system, that is the product of the yield of root and its ether extract, will amount to 1.44 ozs.; in the latter case it is only 0.96 ozs.

In the present investigation, however, it was not considered fair to base the final selection of planting material on figures for the toxicities of the root systems, since in many cases the plants had been spaced too closely and some of those lifted may not have developed properly as regards their root systems. Accordingly the final selection was based on the amount of ether extract, the first 20 plants in order of merit being selected for propagating purposes. The ether extract of the root systems varied from 25.65 to 20.66 per cent., the minimum figure being therefore approximately 1 per cent. above the average.

From the point of view of ether extract the results of analysis of the roots from Serdang must be regarded as disappointing. Compared with previous figures for samples of root from a mixed stock of this species also cultivated at Serdang (1) the average figure of 19.44 per cent. is low. In this connexion it may be mentioned that a figure of 19.44 per cent., calculated on a moisture-free basis, corresponds to 17.50 per cent. on an air-dry (10 per cent. moisture) basis, which

is slightly below the standard figure of 18 per cent. on which the toxic content of roots sold on an ether extract basis is usually fixed.

A further search for high-grade planting material was therefore made. Since previous results of analysis for a sample of root from a mixed stock of this species growing on the Experimental Plantation, Kuala Lumpur, had shown an ether extract of over 27 per cent., calculated on a moisture-free basis (2), the root systems of all the plants of this species at present under cultivation at Kuala Lumpur were analysed.

Forty-seven plants, aged about 36 months, were taken for the experiment. The same procedure as regards separation of roots and their analysis was followed as in the case of the material from Serdang.

Unfortunately the plants had been spaced too closely so that growth was poor and yields of marketable root per plant were low. The figures for marketable root, calculated on a moisture-free basis, ranged from 1.46 to 0.06 ozs. with an average of 0.36 ozs.

Figures for ether extract calculated on a similar basis, varied from 26.83 to 14.78 per cent. with an average of 21.31 per cent.

Table III, in which the figures for ether extract are divided into groups of 1 per cent., indicates the frequency of variation.

Table III.

Species - *Derris malaccensis* var. *sarawakensis*.

Ether Extract of Marketable Roots from Individual Plants at Kuala Lumpur arranged in Groups of 1 per cent.

Ether Extract (moisture-free basis)	No. of Samples
per cent.	
27 — 26	1
26 — 25	5
25 — 24	2
24 — 23	5
23 — 22	6
22 — 21	8
21 — 20	6
20 — 19	2
19 — 18	7
18 — 17	1
17 — 16	2
16 — 15	1
15 — 14	1
	Total 47

Although these figures are lower than anticipated, the average figure is approximately 2 per cent. higher than that found at Serdang, while there are also 6 plants in which the ether extract of the roots lies between 25 and 27 per cent. compared with 1 plant from the batch at Serdang.

As a final selection, the first 20 plants in order of merit of ether extract were taken, the figures ranging from 26.83 to 21.83 per cent., the latter figure being over 1 per cent. higher than the minimum figure for the selected Serdang material.

(b) *Derris elliptica*, Sarawak creeping.

Thirty-six plants, aged between 24 and 25 months, were selected at random at Serdang. The same procedure as that outlined for *D. malaccensis* var. *sarawakensis* was followed as regards separation of roots and their analysis.

The weights of marketable roots, calculated on a moisture-free basis, varied from 8.89 to 0.58 ozs. with an average of 3.69 ozs.

The figures for ether extract calculated on a similar basis, varied from 29.65 to 5.08 per cent. with an average of 24.71 per cent.

The average figure for ether extract is remarkably high and compares favourably in this respect with that for high-quality *D. elliptica* root from Singapore.

Table IV, in which the results for ether extract determinations are divided into groups of 1 per cent. indicates the comparatively narrow range over which the figures varied.

Table IV.

Species - *Derris elliptica*, Sarawak creeping.

Ether Extract of Marketable Roots from Individual Plants at Serdang arranged in Groups of 1 per cent.

Ether Extract (moisture-free basis)	No. of Samples
per cent.	
30 — 29	4
29 — 28	2
28 — 27	5
27 — 26	4
26 — 25	4
25 — 24	6
24 — 23	3
23 — 22	3
22 — 21	2
Below 21	3
	Total 36

Compared therefore with *D. malaccensis* var. *sarawakensis* the figures indicate a much higher ether extract, while the proportion of rotenone to ether extract is also higher. Eight samples of root were selected at random for rotenone determinations with the results shown in Table V.

Table V.

Relationship between Rotenone Content and Ether Extract for Root of *Derris elliptica*, Sarawak creeping.

Serial No. of Plant	Rotenone (moisture-free basis)	Ether Extract (moisture-free basis)	Proportion of Rotenone to Ether Extract
	per cent.	per cent.	per cent.
3	6.74	27.47	24.5
9	7.42	29.65	25.0
13	7.61	26.59	28.6
16	5.55	25.90	21.4
19	6.24	27.04	23.1
22	5.76	24.32	23.7
30	5.92	22.64	26.1
34	6.13	24.13	25.4
		Average	24.7

The results show that the proportions of rotenone to ether extract vary from 21.4 to 28.6 per cent. with an average of 24.7 per cent.

In the case of this species also, 20 plants, based on the amount of ether extract, were selected for propagating purposes, the figures ranging from 29.65 to 24.99 per cent.

(c) *Derris elliptica* (Serdang type).

Although recent work has shown that samples of mixed root from this species of Derris are poor both in rotenone and ether extract (3), the investigation was extended to include a small number of individual plants for the purpose of obtaining the range of variation for this type.

Twelve plants, aged between 24 and 25 months, were selected at random from a plot at Serdang and the same procedure as already outlined for other species followed as regards separation of roots and their analysis.

The weights of marketable roots, calculated on a moisture-free basis, varied from 9.41 to 2.24 ozs. with an average of 5.83 ozs.

The figures for ether extract, calculated on a similar basis, varied from 9.92 to 1.75 per cent. with an average of 6.92 per cent. Table VI, in which the figures are divided into groups of 1 per cent., indicates the frequency of variation.

Table VI.

Species - *Derris elliptica* (Serdang type)

Ether Extract of Marketable Roots from Individual Plants at Serdang arranged in Groups of 1 per cent.

Ether Extract (moisture-free basis)	No. of Samples
per cent.	
10 — 9	1
9 — 8	2
8 — 7	3
7 — 6	4
6 — 5	1
Below 5	1
	Total 12

Estimations of rotenone were carried out on two samples, the results being as shown in Table VII. The figures indicate that the proportion of rotenone to ether extract is approximately 19.5 per cent. for this species.

Table VII.

Relationship between Rotenone Content and Ether Extract for Roots of *Derris elliptica* (Serdang type)

Serial No. of Plant	Rotenone (moisture-free basis)	Ether Extract (moisture-free basis)	Proportion of Rotenone to Ether Extract
	per cent.	per cent.	per cent.
1	1.25	6.30	19.8
12	1.91	9.92	19.1
		Average	19.5

While the weights of marketable roots per plant are greater than those for the first two species, the low range of figures for both rotenone and ether extract precludes this type from being considered as a commercial proposition. No plants were therefore selected for propagating purposes.

(d) *Derris polyantha?*

Twelve plants of this species, aged between 24 and 25 months, were selected at random at Serdang and the same procedure followed as regards the separation of roots and their analysis.

A feature of this species was the wide variation in the weights of marketable roots from individual plants, also the nature of the root. In most cases the root system consisted of long and very gradually tapering individual roots. In one instance the length of such a root exceeded 25 feet. Such roots would be expensive to harvest especially in a soil of compact nature.

The weights of marketable roots, calculated on a moisture-free basis, varied from 21.25 to 2.79 ozs. with an average of 8.17 ozs.

The figures for ether extract, calculated on a similar basis, varied from 17.02 to 9.49 per cent. with an average of 11.82 per cent.

Table VIII, in which the figures are divided into groups of 1 per cent., indicates the frequency of variation.

Table VIII.

Relationship between Rotenone Content and Ether Extract for Roots of *Derris polyantha?*

Ether Extract (moisture-free basis)	No. of Samples
per cent.	
18 — 17	1
17 — 16	—
16 — 15	—
15 — 14	—
14 — 13	2
13 — 12	—
12 — 11	4
11 — 10	3
10 — 9	2
	Total 12

Estimations of rotenone were made on two samples, the results being given in Table IX. The figures indicate that the proportion of rotenone to ether extract for this species is approximately 24.3 per cent.

No plants were selected for propagating purposes. Although the average weight of marketable roots per plant is considerably higher than that found for any of the other species examined, the comparatively low figures for both rotenone and ether extract, which are below the present market requirements, preclude this species also from being recommended for planting on a large scale.

Table IX.

Relationship between Rotenone Content and Ether Extract for Roots of *Derris polyantha?*

Serial No. of Plant	Rotenone (moisture-free basis)	Ether Extract (moisture-free basis)	Proportion of Rotenone to Ether Extract
	per cent.	per cent.	per cent.
2	4.29	17.02	25.2
7	2.53	10.84	23.3
			Average 24.3

(e) *Derris elliptica* (Singapore type).

Planting material and roots from this species, which is cultivated on a large scale in the Changi area, Singapore, were selected. Compared with the usual estate practice a different procedure is followed at Changi as regards cultivation of the plants and harvesting of the roots. A brief description of the methods used is given.

Once the cutting has become established and lateral branches have developed, a short length of each branch is buried or layered to encourage root formation, this process being repeated as the plant develops. Heavy manuring is practised.

Harvesting commences usually when the plants are about 18 months old. The main or anchor root thrown out by the original cuttings is not disturbed, only those roots from the procumbent stems being removed. The roots are carefully severed from the stems, which are raised or bent back while the roots are lifted. When this operation is completed, the procumbent stems are restored to the original positions on the ground, being layered down later, and portions of them covered with soil to induce fresh root development.

Using this method of cultivation and a regular system of heavy manuring, the plants can be maintained on the land for a number of years, the roots being harvested annually.

The soil is very loose and friable and has the appearance of being almost a pure coarse sand. Soil conditions appear to stimulate root development and to facilitate harvesting.

Cuttings and roots from 21 individual plants, which were being harvested for the first time, were collected. The plants were selected at random and included representatives of two races of this species, namely Changi 1 and Changi 2, as described by Henderson (4).

The weights of marketable roots, calculated on a moisture-free basis, varied from 11.85 to 3.18 ozs. with an average of 7.80 ozs.

Determinations of both ether extract and rotenone were made in all cases, since previous work had shown that mixed roots from this species were characterized by a high ether extract combined with a high rotenone content.

The results of analysis are shown in Table X, the figures being grouped as far as possible according to the races to which the individual plants belonged.

The figures indicate wide variations in respect of both ether extract and rotenone for individual plants.

The figures for ether extract vary from 25.10 to 11.14 per cent. with an average of 20.52 per cent.; those for rotenone from 7.16 to 2.30 per cent. with an average of 5.28 per cent.

There are also wide variations in the proportion of rotenone to ether extract, the figures ranging from 31.6 to 16.7 per cent. with an average of 25.5 per cent.

The figures also show similar ranges of variation in all respects for roots from both races of this species.

Table X.

Relationship between Rotenone Content and Ether Extract for Roots of *Derris elliptica* (Singapore type) from Changi.

First Series.

Serial No. of Plant	Rotenone (moisture-free basis)	Ether Extract (moisture-free basis)	Proportion of Rotenone to Ether Extract
	per cent.	per cent.	per cent.
Changi No. 1			
2	5.44	23.68	23.0
3	7.13	24.62	29.0
6*	2.72	16.28	16.7
9	3.70	14.61	25.3
10	3.27	13.66	23.9
14	6.64	23.42	28.3
15	6.95	22.07	31.5
16	6.20	25.10	24.7
17*	5.92	22.73	26.0
18	6.32	23.50	26.9
19	6.01	24.74	24.3
Changi No. 2			
1	2.30	11.14	20.6
4	5.94	22.03	27.0
5*	4.30	13.29	32.4
7	4.85	20.40	23.8
8	6.00	22.28	26.9
20	4.89	22.74	21.5
21	2.46	14.05	17.5
22	5.71	24.00	24.8
23	7.16	22.67	31.6
24	7.09	23.98	29.4
Average (for all plants)	5.28	20.52	25.5

Note:—Doubtful identifications are indicated by an asterisk.

Final selection of planting material for propagating purposes was made from cuttings from the first 13 plants in order of merit of ether extract. The figures ranged from 25.10 to 22.03 per cent., the minimum figure being between 1 and 2 per cent. higher than the average for the whole series. The rotenone content of the selected samples varied from 7.16 to 5.44 per cent.

Compared with the results of analysis for previous samples of mixed root from this source, the average figures for both ether extract and rotenone were considered low, the usual range being of the order

			per cent.
Ether extract	...	...	24 to 26
Rotenone	...	...	8 to 9

Since the plants were only 18 months old, and in addition successive layerings would have resulted in the development of a varying proportion of young roots which would be low in toxic content, material from older plants was obtained. These plants were stated to be 40 months old and to have been harvested only once previously when 24 months old. Cuttings and roots from 20 plants were taken.

The weights of marketable roots, calculated on a moisture-free basis, varied from 27.94 to 8.51 ozs. with an average of 15.46 ozs. These figures showed marked increases over those for the first series.

The results of analysis of the individual samples are shown in Table XI.

Table XI.
Relationship between Rotenone Content and Ether Extract for Roots of *Derris elliptica* (Singapore type) from Changi.
Second Series.

Serial No. of Plant	Rotenone (moisture-free basis)	Ether Extract (moisture-free basis)	Proportion of Rotenone to Ether Extract
	per cent.	per cent.	per cent.
25	6.01	22.85	26.3
26	6.38	25.59	24.9
27	5.71	18.88	30.3
28	8.30	27.05	30.7
29	5.41	22.36	24.2
30	5.15	19.86	25.9
31	5.17	18.82	27.5
32	6.07	25.50	23.8
33	7.81	23.73	32.9
34	6.27	23.40	26.8
35	6.29	28.00	22.5
36	4.85	19.60	24.7
37	9.17	27.91	32.9
38	5.73	21.97	26.1
39	6.18	24.52	25.2
40	7.29	27.49	26.5
41	5.90	25.45	23.2
42	6.19	23.82	26.0
43	7.33	25.80	28.4
44	7.49	25.26	29.6
Average	6.44	23.89	26.9

It will be seen that the figures for ether extract vary from 28.00 to 18.82 per cent. with an average of 23.89 per cent.; those for rotenone from 9.17 to 4.85 per cent. with an average of 6.44 per cent.

The proportion of rotenone to ether extract varies from 32.9 to 22.5 per cent. with an average of 26.9 per cent.

Although there are still wide variations in respect of ether extract, rotenone content and proportion of rotenone to ether extract for roots from individual plants, the range in every case is slightly higher than in the first series as the figures in Table XII show.

Table XII.

Comparison of Toxic Contents between two Series of Samples of *Derris elliptica* (Singapore type) from Changi.

(Moisture-free Basis)

	First Series	Second Series
	per cent.	per cent.
Ether Extract		
Maximum	25.10	28.00
Minimum	11.14	18.82
Average	20.52	23.89
Rotenone		
Maximum	7.16	9.17
Minimum	2.30	4.85
Average	5.28	6.44
Proportion of Rotenone to Ether Extract		
Maximum	31.6	32.9
Minimum	16.7	22.5
Average	25.5	26.9

While the average figures for ether extract and rotenone are still lower than those found for previous samples of mixed root, enquiries made in Singapore showed that the small bundles of Changi root offered for sale are composed of selected individual roots, the long and slightly tapering fleshy roots being frequently sorted out by the growers and reserved for sale in the local market. It would therefore appear reasonable to assume that the toxic content of such roots may be above the average. In any case such roots cannot be considered as typical of the product as exported.

Cuttings from the first 17 plants in order of merit of ether extract were taken for propagating purposes, making 30 plants in all for the two series.

The ether extract of the roots of cuttings from the second series ranged from 28.00 to 19.86 per cent., the rotenone content from 9.17 to 5.15 per cent.

In addition to the samples from Changi the root systems of 7 plants of this species, approximately 36 months old, and growing in the Experimental Plantation, Kuala Lumpur, were also analysed. Two plants were selected for propagating purposes, the root systems of both plants being high in both ether extract and rotenone as the figures in Table XIII show.

Table XIII.

Relationship between Rotenone Content and Ether Extract for Root of *Derris elliptica* (Singapore type) from Kuala Lumpur.

Serial No. of Plant	Rotenone (moisture-free basis)	Ether Extract (moisture-free basis)	Proportion of Rotenone to Ether Extract
	per cent.	per cent.	per cent.
2	8.99	26.92	33.4
5	9.29	25.47	36.4
		Average	34.9

(f) *Derris malaccensis* (Kinta type).

A series of samples of the above species which is characterized by a moderately high ether extract but only a very small proportion of rotenone, has been obtained from the Kinta District in Perak.

The crop is grown largely on old mining land, the soil resembling to a certain extent the sandy soil at Changi.

Twenty-two plants were selected at random on a holding near Malim Nawar. The plants were stated to be approximately 25 months old and were about to be harvested.

The yields of marketable roots, calculated on a moisture-free basis, varied from 8.28 to 1.13 ozs. with an average of 2.99 ozs.

The figures for ether extract, calculated on a similar basis, varied from 22.07 to 14.41 per cent. with an average of 18.79 per cent.

Table XIV, in which the figures for ether extract are arranged in groups of 1 per cent., indicates the frequency of variation.

The rotenone content varied from 0.61 per cent. to nil, so that from the point of view of commercial valuation this species may be regarded as rotenone-free.

Based on an ether extract figure of 20 per cent. on a moisture-free basis, which corresponds to 18 per cent. on an air-dry (10 per cent. moisture) basis,

Table XIV.

Species - *Derris malaccensis* (Kinta type.)

Ether Extract of Root Systems from Individual Plants at Malim Nawar arranged in Groups of 1 per cent.

Ether Extract (moisture-free basis)	No. of Samples
per cent.	
23 — 22	1
22 — 21	2
21 — 20	5
20 — 19	2
19 — 18	5
18 — 17	3
17 — 16	1
16 — 15	1
15 — 14	2
	Total 22

the results indicate that there are only 8 plants in which the ether extract of the root system is in excess of the standard. In making the selection for propagating purposes, two additional samples in which the ether extract figures were between 20 and 19 per cent. were, however, included, since in both cases the figure for the ether extract was less than 0.5 per cent. below the standard.

Summary of Results of Investigation.

A summary of the results of the investigation giving particulars of the numbers of plants selected in each species, together with the limits of variation for ether extract and rotenone, is given in Table XV.

It must be pointed out that the figures for ether extract and rotenone of the different species are not strictly comparable. There are differences in age of plants, nature of cultivation, method of harvesting, any of which may exert an influence on the toxic content of the roots. For example, the results of analysis of roots from plants cultivated according to the Changi system, which is essentially a method to encourage a prolific root formation, are not comparable with those for plants of the same species which have developed naturally and in which at the time of harvesting the whole of the root system is lifted.

It is claimed, however, that the maximum figures do give an indication of the standards of the toxic contents of the roots which may at least be reached in the different species if the plants remain true to type, are not affected by change in environment, and are harvested at the optimum period.

Table XV.

Limits of Toxic Contents of Root Systems of Derris Plants Selected for Trial.

Species of Derris	Location	No. of Plants Selected	Ether Extract (moisture-free basis)		Rotenone (moisture-free basis)		Remarks
			Maximum	Minimum	Maximum	Minimum	
			per cent.	per cent.	per cent.	per cent.	
D. elliptica (Singapore type)	Changi	13	25.10	22.03	7.13	5.44	
— do. —	- do. -	17	28.00	19.86	9.17	5.15	
— do. —	Kuala Lumpur	2	26.92	25.47	9.29	8.99	
D. elliptica, Sarawak creeping	Serdang	20	29.65	24.99	7.30	6.20	The figures for rotenone content are only approximate and are calculated values based on a proportion of 14.7 per cent. as found for certain plants.
D. malaccensis var. *sarawakensis* ...	Serdang	20	25.65	20.66	3.80	3.00	The figures for rotenone content are only approximate and are calculated values based on a proportion of 24.7 per cent. as found for certain plants.
— do. —	Kuala Lumpur	20	26.83	21.83	3.90	3.20	
D. malaccensis (Kinta type)	Malim Nawar	10	22.07	19.57	0.33	Nil	

Outline of Further Work.

The clones have all been planted at Serdang. Two different types of soil have been chosen for the experiment. The first belongs to the valley quartzite type and the soil may be described as consisting of a dark clay loam with 50 to 60 per cent. of the fine fractions; the second belongs to the Raub type and consists of a yellow friable soil with a good crumb structure.

The plants have been set in rows 8 feet apart with 5 feet between plants in the rows, thus ensuring ample space for root development.

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During recent years the cultivation of Derris has spread considerably in the Kinta and Batang Padang Districts of Perak. At the present time, it is estimated that there are some 900 acres under cultivation and the area is increasing. Planting is mainly undertaken on land, held on temporary occupation license by Chinese, surrounding the tin mines in the Kinta valley. It is stated that Derris has been grown for the past fifteen years at Malim Nawar which appears to be the centre of the industry.

Species.

Examination of flowering material and the growing plant in the field inclines the writer to identify the species cultivated as *Derris malaccensis* Prain. This determination is based on the description of the species given by King in *Materials for a Flora of the Malayan Peninsula* (1) and Ridley in *Flora of the Malay Peninsula* (2). King cites two varieties after the description of *D. malaccensis,* based on fruiting specimens alone. It will be necessary for a revision of this group to be made before it may be stated with certainty whether more than one plant is included under this species, as inferred by King. The Kinta plant differs from *D. malaccensis* var. *sarawakensis* Henderson (3) in habit, having much shorter branches, and a more sprawling growth. Further, the branches do not grow erect from the rootstock but bend over and assume a semi-horizontal position, giving the plant a very different appearance from var. *sarawakensis.* It is proposed to refer to the plant grown at Kinta and described here, as *Derris malaccensis,* Kinta type. As regards the toxic content of this Derris, results of analysis conducted by the Chemical Division show that the root is characterized by a very low rotenone content combined with a moderately high ether extract, as indicated by the following figures from material collected from plants nearly two years old.

Derris malaccensis, Kinta type.

	Moisture-free-basis per cent.
Ether extract	19.2
Rotenone	0.2

The plant referred to locally as "tuba merah" fits in the *Derris malaccensis* group, and preliminary analysis shows that the toxicity of the root is of the same order as that of the Kinta plant.

So far as can be ascertained there is only the one species of Derris cultivated in the Kinta District and it is popularly believed that other kinds will not thrive. There is no evidence available in support of this belief, which is probably

erroneous, since in the Changi district of Singapore, *D. elliptica* is grown on sandy soil with conspicuous success. The growth of this crop on the poor soil and tailings in the Kinta District is remarkable, and the plant is evidently well suited to the conditions obtaining.

Cultivation.

In the majority of instances the land planted with Derris surrounds the *atap*-roofed houses built by the occupants. Derris is now the major crop in the mining areas and is considered more remunerative than other forms of temporary cultivation, *e.g.*, tapioca and vegetables. Many of the Chinese growers work or have dependants working on the adjoining tin mines. When preparing the land for planting, all heavy growth is burned off, but weeds and *lalang* grass, *Imperata arundinaceae,* are turned into the soil in order to provide organic matter. The soil is cultivated to a depth of eighteen inches and prepared in as friable a condition as possible for planting.

Cuttings of one foot or less in length are selected from mature plants. These are planted, usually in full sunlight, at an angle and close together, in sandy soil. A site is selected near wells or streams, to facilitate watering. The cuttings root rapidly and are ready for transplanting within twenty to thirty days. The planting distance varies but is usually about 2½ feet by 2½ feet or 3 feet by 3 feet, square planting, and generally two cuttings are planted in each hole. Planting is done during rainy weather. On good soil, frequently no manuring is carried out, but on land previously under cultivation, liquid manure from various sources is applied several times weekly. This continues until the plants are about three weeks old. Where pigs are not kept, cattle manure is purchased from Bengalis for use as liquid manure. Regular weeding is done until the land is well covered with growth, *i.e.* about one year from planting. No pests are reported as causing damage to the crop.

Harvesting.

The time of harvesting varies and is governed to some extent by necessity or the advent of Chinese festivals. The period between planting and harvesting may be two to four years, but usually is about two years. The roots are lifted by means of the changkol or by hand, the sandy soil making this operation an easy one. All the stems are cut and removed in order to leave the land clear for harvesting. The sandy soil renders harvesting less laborious than on heavier soils.

The roots are lifted and cleaned, but not washed, and roughly bundled before being transported to the local buyer. The root is commonly delivered to the buyer in small quantities, frequently by bicycle transport. Harvesting is usually done at intervals so that an advance on the crop may be obtained and the root be disposed of as soon as lifted. Information is available only as to the wet root harvested, as the growers do not dry the root before sale.

Yields.

Yields are stated to range from 14 cwt. to 2 tons per acre depending upon the state of the land. These figures must be accepted with reserve, since it is doubtful whether actual crop records have been taken. The loss of weight on drying is approximately 60 per cent. Twenty plants selected at random, from an area stated to be nearly two years old, yielded an average of $3\frac{1}{4}$ ozs. of air-dry root (10 per cent. moisture) per plant, which at 6,000 plants per acre approximates to a yield of 11 cwt. of dried root per acre. In this instance, the yield of root appeared to be low, probably on account of immaturity, but estimation of yield is a matter of difficulty since no accurate information of the number of plants to the acre is available. A second crop is commonly planted which is stated to yield 24 to 36 cwt. of wet root per acre. Subsequently, or when the land is considered worn out, it is allowed to revert to *lalang* grass or secondary growth. This procedure undoubtedly rejuvenates the land, but the biological processes involved are as yet incompletely understood. There is no suggestion of specific action by *lalang* or any other plant.

Marketing.

There are several Chinese dealers in the district who purchase the fresh root. The dealers dry, bale, and pack the root for export. One large dealer at Malim Nawar has a drying ground, store and baling press, and deals with about 7 tons of root a month. The dried root is pressed into bales weighing 2 cwt.; these are covered with sacking before despatch. Present prices (May, 1936), are $13.50 to $15 per picul (133 1/3 lbs.) for the fresh root and $37 per picul for the dried root, the latter price being obtained by the dealers upon delivery.

Acknowledgments.

The writer wishes to acknowledge assistance in the preparation of these notes, from Major C. D. V. Georgi, Agricultural Chemist. He is also indebted to Mr. C. W. S. Hartley, Agricultural Officer, Perak South, and Mr. Ng Cheng Chong, Chinese Sub-Inspector of Agriculture, for assistance in collecting information in the field.

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CHEMICAL COMPOSITION OF CARPET GRASS FROM SERDANG

BY

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Introductory.

Experiments have been carried out recently to determine the variation in composition of carpet grass (*Axonopus compressus*) when cut at different intervals, since it has been found that cattle do not relish this grass.

Further, since it was also reported that the grass appeared to have a purging effect on some animals, determinations of the hydrocyanic acid content of the grass were made.

A small experimental plot of the grass at the Central Experiment Station, Serdang, was used as a source of supply of material. Three strips were marked off in the plot and the grass in the three strips cut with a scythe. The strips were then cut at intervals of four weeks, five weeks and six weeks respectively. The experiment was continued for a period of four months. Dry weather prevailed during the latter part of the experiment. The grass was sampled immediately after cutting and despatched to the laboratory for analysis.

The analysis of the grass comprised determinations of moisture, crude protein, crude fat, crude fibre, ash, lime and phosphoric acid.

The results of analysis are shown in Table I and II. Average figures for the moisture, crude protein and crude fibre contents of guinea grass (*Panicum maximum*) from the control plots of the manurial experiments now being carried out with this grass at the Central Experiment Station, Serdang, are added for purposes of comparison.

Table I.

Moisture Content of Carpet Grass and Guinea Grass at Varying Intervals of Cutting.

Details	Maximum	Minimum	Average
	per cent.	per cent.	per cent.
Four-Weekly Cutting.—			
Carpet grass ...	75.6	65.2	71.1
Guinea grass ...	78.4	73.7	76.3
Five-Weekly Cutting.—			
Carpet grass ...	72.7	63.3	69.3
Guinea grass ...	76.5	73.7	74.9
Six-Weekly Cutting.—			
Carpet grass ...	75.6	64.3	69.3
Guinea grass ...	77.4	70.9	74.9

Table II.

Results of Analysis of Carpet Grass at Varying Intervals of Cutting.

(Moisture-free Basis.)

Details of Grass	Crude Protein	Crude Fat	Nitrogen-free Extract (by difference)	Crude Fibre	Ash	Lime	Phosphoric Acid
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Four-Weekly Cutting.—							
Carpet grass	8.3	1.7	53.5	30.5	6.0	0.49	0.47
Guinea grass	12.3			30.0			
Five-Weekly Cutting.—							
Carpet grass	7.5	1.4	54.4	30.8	5.9	0.55	0.46
Guinea grass	10.8			29.9			
Six-Weekly Cutting.—							
Carpet grass	7.5	1.4	54.5	30.8	5.8	0.50	0.42
Guinea grass	10.1			29.9			

Observations on Results of Analysis.

The results of analysis indicate that the moisture content of carpet grass is liable to a greater variation than that of guinea grass, especially during spells of dry weather.

It is probable that the lower moisture content may render the grass less succulent and therefore less palatable.

The figures (Table II) also show that the crude protein content of carpet grass is less than that of guinea grass. Further, as would be expected, there is a reduction in the crude protein content with an increase in the age of the grass. The reduction is, however, less marked with carpet grass than with guinea grass.

The crude fibre contents of both grasses are of the same order.

Hydrocyanic Acid Content of Grass.

The average results of the determinations of the hydrocyanic acid content of the grass compared with guinea grass cut at the same intervals of cutting are given in Table III.

Table III.

Hydrocyanic Acid Content of Carpet Grass and Guinea Grass at Varying Intervals of Cutting.

Details	Hydrocyanic Acid
	per cent.
Four-Weekly Cutting.—	
Carpet grass	.0013
Guinea grass	.0014
Five-Weekly Cutting.—	
Carpet grass	.0013
Guinea grass	.0009
Six-Weekly Cutting.—	
Carpet grass	.0010
Guinea grass	.0009

The figures indicate that the hydrocyanic acid content of both grasses is of the same order, the slightly higher figures for carpet grass in two cases being due to the lower moisture content.

General.

The results of the investigation show, therefore, that carpet grass has a lower crude protein content than guinea grass. Further, during dry weather the grass may be less palatable than guinea grass owing to a lower moisture content.

In conclusion the writer wishes to thank Mr. J. Lambourne, Assistant Agriculturist, for arranging the collection of the samples at Serdang, and Inche Othman bin Mohamed Lela for the analytical work.

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CONDITIONS ON RUBBER SMALL HOLDINGS IN MALAYA.

2nd Quarter, 1936.

Prepared by the Economics Branch of the Department of Agriculture, Straits Settlements and Federated Malay States, in collaboration with the Field Branch of the Department.

Rainfall.

June was an exceptionally dry month throughout the Peninsula. April was abnormally dry in most districts and May was wet. Heavy rains were experienced during April in some areas, notably parts of Johore, Perak North and Province Wellesley.

Prices.

Prices remained at the higher level reached in the last month of the first quarter, although there was a slight weakening in May and June in sympathy with the market. Scrap continued to fetch the higher price mentioned in this report for the first quarter.

Table I shews the lowest and highest prices paid for small-holders' rubber at several centres in each State and Settlement, and Table II gives the mean of the range.

Production.

Table III summarizes production of rubber on small holdings during the second quarter. This table is compiled from the monthly report of production, stocks, imports and exports of rubber published by the Registrar-General of Statistics, S.S. and F.M.S.

Tapping.

The results of the quarterly survey of small holdings out of tapping are given in Table IV. The estimates are obtained by counting the number of holdings out of tapping, and applying the percentage to the total area of small holdings in the District.

The table shews that, with the exception of the Federated Malay States, there was a slight decrease in the holdings out of tapping. At the end of June, 1936, the following acreages were estimated to be out of tapping:—Federated Malay States 219,328 (40 per cent.), Straits Settlements 35,595 (29 per cent.), Johore 103,112 (32 per cent.), Kedah 42,300 (42 per cent.). The relative figures at the end of the first quarter (March) were as follows:—219,300 (41 per cent.), 39,400 (33.8 per cent.), 138,600 (43 per cent.), 50,900 (50.5 per cent.).

The acreages estimated to be out of tapping at the end of June 1935 were as follows:—Federated Malay States 144,500 (27 per cent.), Straits Settlements 22,000 (18.9 per cent.).

Table I.

Lowest and Highest Rubber Prices Paid by Local Rubber Dealers.

(In Straits dollars per picul (133 1/3 lbs.))

2nd Quarter 1936.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore
			APRIL					
Smoked sheet	32.50-35.50	29.38-34.50	28.00-34.50	31.00-34.20	30.95-35.60	33.50-34.50	31.00-34.40	32.00-34.80
Unsmoked sheet	31.00-35.00	27.00-33.80	26.00-33.00	29.00-33.00	29.25-33.00	31.50-33.50	30.00-33.20	30.00-34.00
Scrap	25.00-29.00	—	24.00-29.50	26.00-30.00	—	28.00-30.50	27.00-30.50	28.00-30.00
			MAY					
Smoked sheet	31.50-34.00	31.00-34.50	27.50-34.95	30.50-33.80	29.00-34.60	32.00-33.50	32.00-35.00	31.00-33.60
Unsmoked sheet	30.00-33.80	27.00-33.70	29.00-32.00	25.00-32.50	29.00-33.00	30.50-32.50	30.00-34.00	28.50-33.00
Scrap	22.50-28.50	—	22.00-27.25	23.70-29.00	—	27.00-29.50	27.00-30.00	23.00-30.00
			JUNE					
Smoked sheet	31.50-33.70	30.50-34.00	28.00-34.00	30.50-32.90	28.00-34.00	31.50-33.50	31.50-33.50	29.75-34.00
Unsmoked sheet	30.50-33.30	27.00-32.50	29.00-32.00	25.00-31.80	29.00-32.00	30.00-32.50	30.00-32.00	27.50-33.20
Scrap	21.00-28.00	—	22.00-28.00	23.00-29.00	—	28.00-29.50	27.00-30.00	23.50-30.00

Table II.

Mean of Lowest and Highest Rubber Prices Paid by Local Dealers at a number of Centres in each State.

(In Straits dollars per picul (133 1/3 lbs.))

2nd Quarter 1936.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore
			APRIL					
Smoked sheet	33.95-35.00	32.22-33.73	31.83-33.68	31.72-33.64	31.24-33.77	33.50-34.50	32.85-33.98	32.84-34.11
Unsmoked sheet	32.12-33.88	30.79-32.79	29.25-31.40	30.52-32.54	30.44-32.25	31.83-33.00	31.50-32.92	31.74-33.03
Scrap	26.25-27.50	—	26.30-28.85	26.83-29.16	—	28.83-30.00	27.75-30.00	28.36-29.46
			MAY					
Smoked sheet	32.38-33.88	31.96-33.50	30.95-33.32	31.22-33.26	30.33-32.90	32.33-33.00	32.92-33.88	31.84-32.98
Unsmoked sheet	30.88-32.58	29.80-31.98	30.00-31.66	29.10-31.90	29.62-31.75	31.00-32.00	31.62-32.50	30.27-32.15
Scrap	25.12-26.38	—	24.50-24.87	24.56-28.16	—	27.83-28.83	27.66-29.16	26.53-27.72
			JUNE					
Smoked sheet	32.12-33.45	31.52-32.87	31.47-33.47	31.32-32.62	30.45-32.73	31.83-32.92	32.02-33.06	31.65-32.76
Unsmoked sheet	31.25-32.70	29.66-31.32	30.25-31.38	29.35-31.46	29.88-31.38	30.66-31.92	31 05-31.62	30.39-31.77
Scrap	24.50-26.00	—	24.50-25.75	24.66-28.00	—	28.33-29.17	27.16-28.66	26.76-28.08

Table III.

Production of Rubber on Small Holdings.

(in tons)

	Total half-year 1935	1st Quarter 1936	2nd Quarter 1936	Total half-year 1936
Federated Malay States ...	34,110	14,796	13,108	27,904
Unfederated Malay States ...	29,614	11,561	13,549	25,110
Straits Settlements ...	6,299	2,997	3,019	6,016
Total ...	70,023	29,354	29,676	59,030

Ignoring Perlis, Kelantan and Trengganu, in which States the area of rubber small holdings is relatively small, the total area out of tapping on small holdings at the end of the second quarter was estimated to be 400,335 acres or 36.8 per cent. as compared with 448,200 acres (41.8 per cent.) at the end of the first quarter.

Most reports suggest that the increase in tapping is due to the improved price obtainable for uncouponed rubber. There is still a considerable trade in coupons and they are usually sold within a few days of issue. A number of small-holders prefer to rest their trees, and, where paid labour is employed, it is often more economic to dispose of coupons.

An experimental additional count of holdings in tapping was made in the middle of the quarter, and, contrary to expectations, this revealed a decrease in holdings in tapping when compared with the usual count at the close of the quarter. The probable explanation is that rubber was required for sale without coupons at the end of the quarter when ready cash was short. One report stated that tapping was in progress at the end of the quarter to accumulate a stock to cover the next wet period.

Condition of Holdings.

Improvement in the upkeep of small holdings has been noted as a result of the betterment of economic conditions, and the work of the Asiatic Rubber Instructors is resulting in improved systems of tapping, better sheet manufacture, and the use of proper coagulants.

Table IV.

Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less than 100 Acres, at the end of June, 1936.

PERAK

District	Total Tappable area	Total area untapped	Percentage
Batang Padang	33,227	6,977	21
Kinta	36,090	6,498	18
Kuala Kangsar	79,572	21,484	27
Upper Perak	12,680	6,974	55
Larut & Selama	38,210	6,113	16
Krian	9,270	6,208	67
Lower Perak*	25,982	14,290	55
Dindings	9,273	7,418	80
	244.304	75,960	31

SELANGOR

District	Total Tappable area	Total area untapped	Percentage
Klang	15,410	8,629	56
Kuala Langat	23,333	8,633	37
Ulu Langat	39,856	16,340	41
Ulu Selangor	25,857	21,461	83
Kuala Lumpur†	19,327	10,436	54
Kuala Selangor†	9,512	5,136	54
	133,295	70,635	53

NEGRI SEMBILAN

District	Total Tappable area	Total area untapped	Percentage
Seremban	22,176	16,632	75
Tampin	16,961	12,551	74
Kuala Pilah	26,586	7,975	30
Jelebu	8,917	3,764	31
Port Dickson	11,634	5.933	51
	86,274	46.855	57

PAHANG

District	Total Tappable area	Total area untapped	Percentage
Raub	9,342	5,411	58
Kuala Lipis	14,588	3,209	22
Bentong	11,574	3,124	27
Other Districts†	40,383	14,134	35
	75,887	25,878	34

MALACCA

District	Total Tappable area	Total area untapped	Percentage
Central	13,109	4,325	33
Alor Gajah	30,203	12,685	42
Jasin	22,883	6,636	29
	66,195	23,646	36

PENANG & P. WELLESLEY

District	Total Tappable area	Total area untapped	Percentage
North	3,941	512	13
Central	9,549	4,010	42
South	7,508	5,180	69
Penang	15,822	1,424	9
	36,820	11,126	30

SINGAPORE

District	Total Tappable area	Total area untapped	Percentage
Singapore	20,591	823	4
	20,591	823	4

Johore	322,225	103,112	
Kedah	100,691	42,300	42

The percentage of areas out of tapping in March, 1936, was as follows:—Perak 40, Selangor 34, Negri Sembilan 70, Pahang 29, Malacca 35, Penang and Province Wellesley 36, Singapore 8.

* Estimated from percentage for Kuala Kangsar.

†Estimated from percentage for other Districts in the State.

Diseases.

Mouldy Rot was considerably in evidence during the quarter when the wet month of May encouraged its incidence; the dry weather of June, however, enabled it to be kept under control. Some cases of *Oidium Heveae* were reported, principally in Perak and Kedah, but the trees affected soon made a natural recovery.

Serious cases of root disease were reported in various districts of Perak, and also in Negri Sembilan; a few cases were reported from Johore.

Sporadic cases of Pink Disease occurred in Pahang, and also in Kedah. Fairly serious soil wash was found on a few holdings in the Kuala Pilah District of Negri Sembilan.

Grades of Rubber.

There has been an increase in the production of scrap rubber during the quarter. There is still a preference for unsmoked sheet shewn in a large number of districts, due to the slight difference in price obtainable for the smoked grade.

Kedah.—There was a reduction in the sales of smoked sheet, this being offset principally by increased production of scrap. The percentages of smoked sheet, unsmoked sheet and scrap respectively were: North Kedah 79, 11, 10; Central Kedah 37, 34, 29; South Kedah 62, 21, 17.

Perak.—Increased production of smoked sheet is noteworthy in the reports from this State, and this can doubtless be directly attributed to the adoption of the new smoke-house. In Selama, the sheet sold was, as usual, almost entirely smoked, and in Bagan Serai the percentage of smoked sheet rose slightly, being 35 per cent. to 65 per cent. unsmoked.

In Perak North smoked sheet was sold only at two centres, Taiping and Trong, sales at other centres being of unsmoked sheet. The sales at Taiping are principally from smaller dealers and cannot therefore be taken into account, but the percentage of smoked sheet sold at Trong has increased.

In Perak Central the sales of smoked sheet were larger than those of unsmoked, *e.g.* smoked 55, unsmoked 45. In Perak South also the percentage of smoked sheet has risen: smoked 46, unsmoked 54.

Selangor.—There was a marked preference for smoked sheet, and the production of unsmoked sheet was decreasing.

Penang and Province Wellesley.—The proportion of unsmoked sheet was less during the quarter under review, being replaced by scrap; percentages were: smoked sheet 10, unsmoked sheet 77, scrap 13.

Malacca.—The percentage of smoked sheet increased in Central District, but decreased in Jasin District. Percentages were: Central, smoked 93, unsmoked 4; Alor Gajah, smoked nil, unsmoked 98; Jasin, smoked 26, unsmoked 71.

Negri Sembilan.—There was a slight decrease in the proportion of smoked sheet sold during the quarter, the average percentages of the sales of 24 dealers being: smoked 51; unsmoked 49.

General.

Approximately forty smoke houses have been erected during the quarter under review; these are of the type demonstrated by the Asiatic Rubber Instructors and can be made at a particularly low cost. Continuous efforts are being made to help the small-holder to realize the value of preparing good quality smoked sheet.

In this connexion the experiment in progress in Pahang is of particular interest, and was referred to briefly in this report for the first quarter. Dealers in that State are required to display boards stating the prices paid for the various grades together with samples of the grades; there are six of these, and prices are based either on the standard Kuala Lumpur prices or on the Singapore market. Dealers are asked, however, to make a greater cut in prices for the lower grades than is done in the Kuala Lumpur market, but a premium of 20 to 50 cents per picul is given for No. 1 quality, and of 5 cents for No. 2 quality.

The scheme was introduced at the beginning of this year, and is now working smoothly. The first quarter was principally occupied in ensuring that dealers fully understood instructions and were correctly carrying them out. Attention was then given to instructing small-holders in the use of the boards and samples displayed. This work is naturally slow, but there is no doubt that even after the short period of two or three months, small-holders have been made to realize (1) that there are such things as grades, (2) that their own product is far from first class, and (3) that if they produce a better grade product they will be paid more for it.

There are already a few definite signs that the scheme is working out as expected. All owners of smoke cabinets are now satisfied with the price they obtain for their product and all state that they receive extra money both for smoking and also for the better grade. The rubber dealers' receipt books also indicate that whereas a few months ago all rubber irrespective of quality received one price, now as many as four or five different prices may be paid on any one day.

Several District competitions were held during the quarter in connexion with the All-Malayan Small-Holders' Rubber Competition, and reports indicate that the exhibits received have in some cases reached a particularly high standard.

Abstract.

COMBATING THE WARBLE FLY PEST.

A systematic campaign of extracting the grubs and destroying them greatly reduces the average number of grubs per animal in the herd. But the squeezing out of the ripe maggots is a very troublesome and expensive procedure in a large stock farm like the Government Cattle Farm, Hissar.

Numerous experiments and demonstrations on a field scale and particularly in Worcestershire and Gloucestershire, England, have proved that the only method of offering any hope of the ultimate eradication of the warble fly consists in dressing the backs of cattle with a suitable preparation to destroy the larvae and thus prevent their hatching out into flies which would lead to a further infestation. The use of the following larvicides has been reported by different workers:—

1. *Derris Root Powder.*—Extensive work has been carried out during the past four or five years under the auspices of the Leather Sellers' Company's Warble Fly Committee, England. This Committee advocates a remedy consisting of a wash made from powdered derris root, soft soap, and water, and the experiments which have been carried out by this Committee, involving the dressing of scores of thousands of cattle with this preparation, have proved beyond doubt that this is a remedy which is easy of application, effective in its results and practically negligible in its cost. The following preparation is usually used for the dressings:—

Derris root powder	16 oz.
Soap	4 oz.
Water	1 gallon.

Derris root powder has also been used in other parts of the world in the following forms:—

A.	Derris powder	1 oz.
	Water	1 qrt.
B.	Derris powder	1 part
	Petroleum	20 parts

C. Derris root powder alone dusted in the holes of the warble cells.

In the case of A and B the preparation is applied to the back of the animals with a stiff brush. Only one or two applications are called for.

2. *Some Other Popular Preparations in Use*—

(a) *Nicotine sulphate* (40 per cent. nicotine):—

Nicotine sulphate	1 fl. oz.
Fresh hydrated lime	1 lb.
Water	1 gallon.

It is claimed by some workers that this mixture kills 83 to 100 per cent. of the grubs, and that nicotine dust (2 per cent.) dusted into holes kills 100 per cent.

(b) *Pyrethrum ointment*:—

Pyrethrum powder	...	...	1 part
Petroleum	...	...	2 parts.

When this ointment is pressed into the warble holes, it gives 100 per cent, results.

(c) *Iodoform ointment*:—

Iodoform	...	...	1 part
Vaseline	...	...	4 parts.

As many as five dressings are required before the warbles are cleared out. Its troublesome application and its enormous expense does not justify this treatment.

(d) *Benzole or carbon tetra-chloride* has also been tried but this method of treatment is now discarded for the same reasons.

(e) Kerosene oil, carbolic acid, and gram's solution have also been given a trial. Kerosene oil has been found useless; gram's solution had no effect; and carbolic acid was found very effective for killing the grubs but it severely injured the hides and hair in the region of the warble opening.

(f) In some countries it has also been fully ascertained that with arsenical dips, if systematically employed for the eradication of ticks, the number of warbles is greatly reduced in the following season.

The foregoing is an abstract from "A Review of the Warble Fly Pest in India and Measures for its Control, with Particular Reference to the Government Cattle Farm, Hissar" by B. N. Handa, M.R.C.V.S., Assistant Superintendent (Stock), Government Cattle Farm, Hissar, in *Agriculture and Live-stock in India,* Vol VI, pt. II, 1936.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports by Agricultural Officers.

July, 1936.

The Weather.

The weather was exceptionally dry, even for July, in most parts of the Peninsula and precipitation was below normal at most recording stations. A belt along the coast of Negri Sembilan, Malacca and Johore provides an exception to this generalization, for all records received from coast stations between Port Dickson and Kukup show a precipitation well above normal, the rainfall being so much in excess in certain localities in Johore as to cause flooding of padi areas.

In Kedah, although rainfall approximated to normal, there were occasional heavy showers and high wind, which probably presage an earlier break of the long wet season than occurred last year.

Remarks on Crops.

Padi.—The water supply was a little restricted over parts of Krian towards the end of the month, but, notwithstanding the very dry weather that prevailed generally, no serious damage is reported from anywhere on account of drought.

Planting commenced in North Kedah, whilst in other parts of that State ploughing proceeded satisfactorily under good conditions. Fair progress was made in establishing nurseries in Province Wellesley and conditions are slightly more forward in Penang. In Perak, good progress in clearing the land was made in Krian District, and water supplies were good in the earlier part of the month, but were somewhat reduced at the end of the month, especially in the Selinsing and Semanggol areas. In Larut District generally, water shortage has caused delay in commencing operations. Even in Bukit Gantang, where water has been plentiful as the result of the better irrigation facilities provided last year by the erection of a permanent dam, cultivators have made little attempt to commence operations. Cultivation and the establishment of nurseries of long season strains was in hand in Kuala Kangsar and Upper Perak Districts. Water has been plentiful in Stage I of the Sungei Manik area and many nurseries were established and seedlings have made good growth. Most cultivators in this area have adopted the *rakit* type of nursery and there are indications that this may prove the best type for adoption generally in the area. In Stage II, burning of felled timber was begun on July 15th. A good burn was obtained on a portion of the area where special care had been taken to cut up branches, but was uneven elsewhere. Experience gained this year indicates that, with jungle of this type and under the conditions obtaining, it is unwise to leave the felled trees lying too long before burning is

done. The original intention was to allow the felled timber to remain three months before burning, but it was found that this resulted in a heavy growth of leafy shoots which hampered burning, even though this operation was begun a fortnight earlier than the time originally fixed.

In Selangor, clearing and internal bunding continued at Panchang Bedena and a fairly successful burn was completed on part of this year's new clearing. The burn was less satisfactory on the most recently felled portion of the area and in the Sungei Panjang area. In Negri Sembilan, growth and progress of the crop is reported to be satisfactory, except at Ulu Beranang, where delay was occasioned by water difficulties and in Kuala Pilah District, were operations are late and irregular. In Malacca, plants in the nurseries have made good growth and transplanting was begun in some inland areas. Progress reports from Pahang are also generally satisfactory, though slight water shortage was reported from parts of Raub District. In Kelantan, excessive rainfall has retarded the cultivation of land for dry padi, so that the crop inevitably will be late and prospects are considered to be consequently only fair.

Rubber.—There was an increase in the price paid for small-holders' rubber during the month, some sales being recorded at $35 per picul for smoked sheet.

Many reports give brief details indicating that marked improvement has recently taken place in many parts of the country in the preparation of the commodity by small-holders. This has resulted from propaganda by Asiatic Rubber Instructors and Departmental officers and demonstrations of the smoking cabinet at the many Agricultural Shows that were held during the month.

Examination of smoked sheet exhibits at Agricultural Shows indicates that tackiness is a very common fault of small-holders' rubber. This is often the result of the use of an excessive amount of coagulants and of failure to wash adequately after rolling. These items have been noted for correction in areas where the fault has been specially marked at local Shows.

The Agricultural Officer, Johore North Circle, reports that small-holders at Panchor have been induced recently to co-operate in buying formic acid in bulk. This is of special interest, as Panchor was once notorious for the use of large amounts of alum as a coagulant.

Six further cabinets are reported to have been under erection during the month in Batu Pahat District of Johore, three in Negri Sembilan, and two in Batang Padang District of Perak.

Some reports indicate that there is a tendency in certain areas towards a widening margin in the price offered locally for unsmoked and smoked sheet. Should this tendency spread and become a permanent feature, it is bound to result in increasing amounts of smoked sheet being prepared by small-holders. The fact that local quotations for smoked sheet have in the past shown only a small premium over unsmoked sheet is largely because small dealers in country districts have practised no system of grading, their bulked produce having been sold to larger dealers at one price. A general extension to small dealers of the practice of grading is a necessary preliminary to any substantial widening of the

margin of prices offered by them for poor and good quality rubber. The Pahang scheme has resulted in grading being adopted by a number of dealers in that State who had not practised it previously.

Copra.—The price of copra further hardened slightly during the month, the Penang quotation for f.m.s. reaching $5.50 per picul towards the end of the month.

Demonstrations of the smoke cabinet for copra were given at a large number of the Shows during the month. Those erected in Johore and elsewhere are working satisfactorily. All the approved kilns erected in the Bagan Datoh area of Perak, both the Ceylon and cabinet types, were employed during the month and turned out estate-quality copra. In the north of Province Wellesley there was a brisk demand for fresh nuts for export as expected and, as the price offered was $22 per 1,000 nuts, they were not available for the local kilns at a paying price. Further smoke cabinets are under erection in the Bagan Datoh area of Perak, in the Kukup District of Johore and in the North and Central Circles of that State.

Agricultural and Padi Stations and Test Plots.

Agricultural Stations.—Reports are mainly concerned with routine maintenance. At a few Stations groundnuts and similar crops were harvested and further satisfactory progress is reported to have been made in stumping and *lalang* grass eradication at the Johore Pineapple Station.

Padi Stations and Test Plots.—The preparation of the land and establishment of nurseries took place at the Kedah Station and Plots and at most of the Stations and Plots in Perak. An exception is Bukit Gantang Test Plot, where delay in making a start is occasioned by the reluctance of surrounding cultivators to begin operations. In Negri Sembilan, nurseries were established at Ampang Tinggi Test Plot, and transplanting was in progress at the Kendong Plot and was completed at the Kuala Klawang Plot. At Pulau Gadong Station in Malacca, seasonal operations proceeded satisfactorily with manual labour, but considerable difficulty has been experienced with the mechanical cultivation trials owing to excessive water interfering with drilling operations. In Pahang, sowing was done at Lipis and Dong Plots and transplanting was completed on the Kerdau Plot. In Kelantan, nurseries of wet padi were sown at the Pasir Puteh and Central Stations. At the Central Station the third ploughing for dry padi was delayed on account of rain, but was begun towards the end of the month. At Bachok, the third ploughing was completed satisfactorily. In Johore, some planting was done at Tangkak Plot and further nurseries sown, whilst planting was nearly completed at Jementah Plot.

Agricultural Shows.

Two State Shows and eighteen District Shows were held during the month in addition to a large number of Mukim Padi and Rubber Competitions organized in connexion with the Thirteenth Malayan Exhibition.

Particulars regarding these Shows will be given in a later issue of this Journal.

DEPARTMENTAL NOTES.

Tours of the Adviser on Agriculture.

The Hon'ble the Acting Director of Agriculture, S.S., and Adviser on Agriculture, Malay States, attended the Kuala Langat District Show on 11th July, and on the 18th July the Kuala Selangor District Show at which he judged the padi exhibits. He also attended the Johore State Agricultural Show at Muar on 23rd July, and the District Shows at Seremban, Negri Sembilan, and Kajang, Selangor, on the 25th and 26th July, judging the padi exhibits at both the latter Shows.

Selangor Pineapple Advisory Committee.

His Highness the Sultan of Selangor has appointed Mr. W. J. B. Johnson of the Department of Agriculture, S.S. and F.M.S., to be a member of the Selangor Pineapple Advisory Committee.

Tours of the Rural Lecture Caravan.

The Malacca tour of the Rural Lecture Caravan, commenced during June, was completed by a visit to Bukit Tinggih on July 1st and 2nd. This tour was of some three weeks duration (from June 10th to July 2nd inclusive) and eleven centres were visited, at all of which attendences are reported to have been very satisfactory. Except for one night when rain prevented a show being given the weather was favourable.

On July 9th a tour of Negri Sembilan commenced with a visit to Nilai. The tour arranged was also of three weeks duration (July 9th to 28th inclusive) and provided for visits to ten centres including an appearance at three District Shows, namely, at Kuala Klawang on the 11th and 12th, at Rembau on the 17th and 18th, and at Seremban on the 25th and 26th. No detailed report is yet to hand regarding this tour, but a note in the monthly report of the State Agricultural Officer indicates that the tour was carried through in a satisfactory manner.

Statistical.

MARKET PRICES.

July, 1936.

Major Crops.

Rubber.—The market continued its upward tendency and, for the first time, reached 27 cents, the average for the month being 1.10 cents per lb. higher than the previous month. Spot loose opened in Singapore at $26\frac{5}{8}$ cents per lb. and rose to $27\frac{1}{4}$ cents on the 13th July; thereafter the price fluctuated from $26\frac{3}{4}$ to 27 cents, closing on a falling market at $26\frac{7}{8}$ cents per lb.

The average price for the month of No. 1. X. Rubber Smoked Sheet was 26.92 cents per lb. as compared with 25.82 cents in June. The London average price was 7.70 pence per lb., and the New York price 16.4 cents gold, as compared with 7.34 pence and 15.76 cents gold in the previous month.

Prices paid for small-holders' rubber at three centres during July are shewn in the following table.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, July, 1936.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.					Kuala Kangsar, Perak.					Batu Pahat, Johore.				
	2	9	16	23	30	1	8	15	22	29	1	8	15	22	29
Smoked sheet					34.66	33.50	34.50	34.19				34.30	34.25		
Unsmoked sheet	32.45	33.16	33.30	33.00	33.50	32.04	32.95	32.71	32.85	32.80	32.35	32.60	33.00	33.00	32.80
Scrap	28.00	29.00	29.00	28.50								28.00	28.20		

Transport by F. M. S. R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent

Palm Oil.—Prices improved considerably during July and are given in Table II.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1936.	Palm Oil in Bulk, c.i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
July 3	16. 8. 9	9. 5. 0
" 10	17. 0. 0	10. 0. 0
" 17	17. 12. 6	10. 5. 0
" 24	18. 5. 0	10. 5. 0
" 31	18. 10. 0	10. 7. 6

Copra.—The market again improved steadily throughout the month, with a slight weakening at the close. The sun-dried grade opened in Singapore at $5.05 per picul and rose to $5.40, falling to $5.15 at the close. The average price for the month was $5.25 per picul as compared with $5.00 in June. There was a wider difference between the grades, the mixed quality averaging $4.82 per picul, as compared with $4.74 in the previous month.

Copra cake rose to $1.75 per picul, the monthly average being $1.62 as compared with $1.46 in June.

Rice.—The average wholesale prices of rice per picul in Singapore in June were as follows:—Siam No. 2 (ordinary), $3.75, Rangoon No. 1 $3.50, Saigon No. 1 $3.50, as compared with the May corresponding prices of $3.95, $3.55 and $3.65. The relative prices in June 1935 were: $4.34, $3.80 and $3.87.

The average retail market prices in cents per gantang of No. 2 Siam rice in June were: Singapore 28, Penang 30, Malacca 26, as compared with 28, 28 and 26 respectively in May.

The average declared trade value of imports of rice in June was $3.64, as compared with $3.60 (corrected figure) in May, and $3.66 in April.

Padi.—The Government Rice Mill in Perak continued to pay $1.90 per picul for padi, but only a very small quantity was purchased. Retail prices of padi ranged from 6 to 12 cents per gantang.

Pineapples.—Packers advanced prices during the month, and average prices per case were: Cubes $3.49, Sliced Flat $3.16, Sliced Tall $3.49, as compared with $3.12, $3.01 and $3.12 respectively in June.

Prices of fresh fruit per 100 were:—Johore 1st quality $2 to $3.20, 2nd quality $1 to $3. 3rd quality 60 cents to $1.80; Selangor $1.20 to $1.40.

Beverages.

Tea.—Nine consignments of Malayan tea were sold on the London market during July; two of upland tea were sold for 1s. 0d. and 1s. 0½d. per lb. and the lowland tea ranged from 11¼d. to 11¾d. per lb.

Average London prices per lb. during July for consignments of tea from other countries were as follows:—Ceylon 1s. 1.04d., Java 10.33d., Indian Northern 1s. 0.15d., Indian Southern 1s. 0.02d., Sumatra 9.94d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report,* 28th July, 1936, of the Colombo Brokers' Association, and are as follows (rupee cents per lb.):—High Grown Teas 74 cents, Medium Grown Teas 65 cents, Low Grown Teas 60 cents.

Coffee.—The price of Sourabaya coffee in Singapore improved in July averaging $13.16 to $14.35 per picul according to quality, but Palembang coffee was lower, averaging $6.80 to $7.70 per picul as compared with $7.37 to $8.37 in June.

Spices.

Arecanuts.—The following are the averages of the range of prices per picul in Singapore during July: Splits $4.90 to $6.40; Red Whole $4.60 to $6.50; Sliced $9.20 to $10.75.

The Singapore Chamber of Commerce prices continued to rise, with the exception of the Medium grade. Average prices were: Best $6.91, Medium $6.35, Mixed $5.41; as compared with $6.76, $6.38 and $5.18 in June.

Pepper.—Nominal quotations in Singapore were still further marked down during July, and closed at: Singapore Black $8, Singapore White $14, Muntok White $14.50 per picul.

Nutmegs.—Prices in Singapore continued unchanged during July, and were $28 and $29 per picul respectively for 110's and 80's.

Mace.—Both Siouw and Amboina continued unchanged at the June closing prices of $85 and $70 per picul respectively.

Cloves.—There was no change in the nominal quotations of $38 per picul for both Zanzibar and Amboina.

Cardamoms.—Green cardamoms were quoted during July in the Ceylon Chamber of Commerce reports at Rs. 1.65 to Rs. 1.76 per lb., rising to Rs. 1.70 to Rs. 1.83 at the close of the month.

Miscellaneous.

Derris (*Tuba Root*).—Throughout the month a dull and easier market prevailed owing to the seasonal falling off of demand, and prices were marked down from $1 to $2 lower than last month. The average price per picul for July for roots sold on rotenone content was $48, and $33 for roots sold on the basis of ether extract.

Gambier.—Prices in Singapore fell still further during July, averaging \$4.75 and \$9.88 per picul respectively for Block and No. 1 Cube, as compared with \$5.19 and \$10.38 in June.

Tapioca.—Prices in Singapore remained unchanged at: Flake, Fair \$5.50, Seed Pearl \$5.50, Medium Pearl \$6.50 per picul.

Sago.—Prices in Singapore improved during July, and averages per picul were: Pearl, Small Fair, \$3.92, Flour, Sarawak Fair, \$2.44, as compared with \$3.89 and \$2.25 respectively in the previous month.

Tobacco.—Prices for dried locally-grown leaf ranged from \$10 to \$40 per picul according to grade. Specially prepared leaf in Selangor was quoted at \$100, \$80 and \$60 per picul for 1st, 2nd and 3rd grades respectively.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Kohyei & Co., Singapore.

1 picul = $133\frac{1}{3}$ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY*

June, 1936.

Malaya.—Imports of foreign rice during June were 63,519 tons, and exports 14,461 tons. Net imports for the first half year totalled 260,372 tons, an increase of 17.6 per cent. as compared with 221,322 tons in 1935.†

Of the June imports, 54 per cent. were consigned to Singapore, 15 per cent. to Penang, 7 per cent. to Malacca, 18 per cent. to the Federated Malay States, and 6 per cent. to the Unfederated Malay States. The imports by countries of origin were as follows:—Siam 64.7 per cent., Burma 27.5 per cent., French Indo-China 7.0 per cent., and other countries 0.8 per cent.

Of the exports during June, 79 per cent. were consigned to the Netherlands Indies, and 21 per cent. to other countries. The various kinds of rice exported were as follows (in tons, percentages in brackets): Siam 11,199 (77.4), Burma 2,409 (16.7), French Indo-China 643 (4.4), parboiled 153 (1.1), local production 57 (0.4).

India and Burma.—Foreign exports of rice during the first five months of the year totalled 665,000 tons, as compared with 1,023,000 tons in 1935, a decrease of 35 per cent. Of these exports 4.4 per cent. were to the United Kingdom, 21.2 per cent. to the Continent of Europe, 26 per cent. to Ceylon, 18.6 per cent. to the Straits Settlements and the Far East, and 29.8 per cent. to other countries. The corresponding 1935 percentages were 4.7, 12.2, 19.2, 32.9 and 31.

Burma's total exports of rice and bran (*Bangkok Times,* 29th June, 1936) from the 1st January to 2nd May were 1,414,468 metric tons, as compared with 1,549,563 metric tons in 1935, a decrease of 8.7 per cent.

Siam.—The latest information was included in the May Summary.

Japan.—According to a report received, dated 13th July, 1936, the first Formosan rice crop is estimated to produce 665,599 tons which will constitute a new record.

French Indo-China.—Entries of padi into Cholon during the first half of this year totalled 891,556 metric tons, a decrease of 19.1 per cent. as compared with 1,102,656 metric tons in 1935. Exports of rice for the same period decreased by 19.2 per cent., being 951,575 metric tons as compared with 1,177,257 metric tons in 1935.

The Netherlands Indies.—The latest information available was published in the February Summary.

Ceylon.—Imports during the first half year totalled 270,682 tons as compared with 254,073 tons in 1935, an increase of 6.5 per cent. Of these imports 12.9 per cent. were from British India, 60.8 per cent. from Burma, 0.2 per cent. from

* Abridged from the Rice Summary for June, 1936, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935.

the Straits Settlements, and 26.1 per cent. from other countries. The relative percentages for 1935 were 11.7, 71.0, 1.3, and 16.

Europe and America.—Shipments to Europe from the East during the period 1st January to 12th June totalled 617,744 tons, an increase of 40.6 per cent. as compared with 439,363 tons in 1935. Of these shipments 36.6 per cent. were from Burma, nil from Japan, 54.6 per cent. from Saigon, 7.3 per cent. from Siam and 1.5 per cent. from Bengal. The corresponding 1935 percentages were 65.4, 3.7, 24.2, 4.3 and 2.4.

Shipments for the Levant from the 1st January to 9th June were 7,553 tons, as compared with 21,678 tons in 1935, a decrease of 65.2 per cent. Shipments for Cuba, West Indies and America from 1st January to 4th June totalled 111,338 tons, a decrease of 4.7 per cent. as compared with 116,790 tons in 1935.

MALAYAN PRODUCTION (IN TONS) OF PALM OIL AND KERNELS

(As declared by Estates)

Month 1936	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S
January ...	1,395.4	326.5	258.6	37.2
February ...	1,531.9	372.4	244.2	54.6
March ...	1,878.4	534.5	302.9	88.0
April ...	1,410.6	446.8	250.0	80.0
May ...	1,346.1	644.8	238.1	114.6
June ...	1,557.4	658.3	245.5	100.9
Total ...	9,119.8	2,983.3	1,539.3	475.3
Total January to June 1935 ...	6,540.3	2,408.3	1,019.0	345.7
Total for year 1935 ...	17,338.7	5,764.6	2,711.1	818.4

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 30TH JUNE, 1936.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1935	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING (a)		AREA OF TAPPABLE RUBBER NEVER BEEN TAPPED		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,526	387	0.9	16,620	37.3	503	1.1	17,007	38.2
Malacca	121,601	4,775	3.9	32,107	26.4	2,871	2.4	36,882	30.3
Penang Island	2,575	Nil	Nil	569	22.1	283	11.0	569	22.1
Singapore Island	34,525	4,275	12.4	8,916	25.8	394	1.1	13,191	38.2
Total S.S. ...	203,227	9,437	4.6	58,212	28.7	4,051	2.0	67,649	33.3
FEDERATED MALAY STATES :—									
Perak	294,988	12,123	4.1	72,760	24.7	14,685	5.0	84,883	28.8
Selangor	332,165	11,902	3.6	72,857	21.9	16,920	5.1	84,759	25.5
Negri Sembilan	258,304	15,807	6.1	54,571	21.1	16,893	6.5	70,378	27.2
Pahang	77,210	9,825	12.7	27,454	35.6	17,976	23.3	37,279	48.3
Total F.M.S. ...	962,667	49,657	5.2	227,642	23.6	66,474	6.9	277,299	28.8
UNFEDERATED MALAY STATES :—									
Johore	432,443	37,567	8.7	66,505	15.4	40,279	9.3	104,072	24.1
Kedah	199,607	10,352	5.2	25,115	12.6	16,109	8.1	35,467	17.8
Kelantan	30,474	403	1.3	10,357	34.0	5,283	17.3	10,760	35.3
Trengganu (b)	4,643	Nil	Nil	15	0.3	179	3.9	15	0.3
Perlis (c)	1,575	Nil	Nil	689	43.7	64	4.1	689	43.7
Brunei	6,010	Nil	Nil	1,603	26.7	963	16.0	1,603	26.7
Total U.M.S. ...	674,752	48,322	7.2	104,284	15.4	62,877	9.3	152,606	22.6
TOTAL MALAYA ...	1,840,646	107,416	5.8	390,138	21.2	133,402	7.2	497,554	27.0

Notes :—(a) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(b) Registered Companies only.
(c) Rendered quarterly.

MALAYAN RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JUNE, 1936, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January to June 1936		during the month		January to June 1936						
	Ports	Dealers	Estates of 100 acres and over	during the month	January to June 1936	during the month	January to June 1936	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to June 1936
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES:—																				
Federated Malay States ...	...	7,091	11,072	10,553	57,845	4,118	27,904	Nil	Nil	Nil	Nil	10,181	4,999	65,621	21,321	...	5,708	11,936	10	47
Johore ...	...	2,295	*3,939	4,256	23,784	2,975	17,209	Nil	115	Nil	414	2,315	4,763	13,064	27,695	...	2,238	4,264	...	...
Kedah ...	...	351	2,521	2,551	14,921	707	3,815	Nil	Nil	Nil	Nil	1,238	1,796	8,139	11,066	...	238	2,858	...	...
Perlis ...	...	7	17	9	64	17	110	Nil	Nil	Nil	Nil	Nil	26	Nil	174	...	4	20	...	...
Kelantan ...	...	254	263	294	1,638	420	2,984	Nil	Nil	Nil	Nil	68	650	817	3,843	...	240	273	...	...
Trengganu ...	...	55	50	251	1,320	126	661	Nil	Nil	Nil	Nil	Nil	377	Nil	1,981	...	55	50	...	...
Brunei ...	...	13	37	48	247	46	331	...	...	...	...	...	92	...	579	...	3	49	...	...
Total Malay States	...	10,066	17,899	17,962	99,819	8,409	53,014	Nil	115	Nil	414	13,802	12,703	87,281	66,659	...	8,486	19,450	10	47
S. SETTLEMENTS:—																				
Malacca ...	...	2,319	1,167	1,019	5,894	702	3,347	Nil		Nil		1,908		12,996		...	2,850	1,206	...	...
Province Wellesley	...	947	532	412	2,335	285	1,273	Nil		Nil		6,057		41,341		...	1,423	566	...	...
Penang ...	1,357	4,805	11	18	100	203	537	2,878	11,455	15,069	65,185	18,282	Nil	105,339	Nil	2,041	5,188	10	...	...
Singapore ...	3,083	17,442	176	152	871	271	761	12,102		70,221						2,795	18,236	160	27	134
Labuan ...	...	17	Nil	Nil	Nil	24	98	46		430		Nil		Nil		...	15	Nil	...	...
Total Straits Settlements ...	4,440	25,530	1,886	1,601	9,200	1,485	6,016	15,026	11,455	85,720	65,185	26,247	Nil	159,676	Nil	4,836	27,712	1,942	27	134
Total Malaya ...	4,440	35,596	19,785	19,563	109,019	9,894	59,030	15,026	11,570	85,720	65,599	40,049	12,703	246,957	66,659	4,836	36,198	21,392	37	181

*Amended

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	4,711	17,520	4,887	3,794	2,007	139
WET RUBBER	997	716	301	497	231	99
TOTAL ...	5,708	18,236	5,188	4,291	2,238	238

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to June 1936
29	30	31
Singapore ...	25,844	157,103
Penang ...	8,984	60,088
Port Swettenham.	5,049	28,376
Malacca ...	172	1,390
MALAYA ...	40,049	246,957

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to June 1936
32	33	34
Malay States ...	26,505	153,940
Straits Settlements	2,883	14,113
MALAYA ...	29,388	168,053

Notes:—
1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 24th July, 1936.

METEOROLOGICAL SUMMARY, MALAYA, JUNE, 1936.

Locality.	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B.	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total.	Total.	Most in a day. Amt.	Number of days: Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total.	Daily Mean.	Per cent.
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	91.3	71.5	81.4	96	68	82	74	84.6	85.3	4.41	112.0	1.55	13	9	4	1		203.00	6.77	55
Bukit Jeram, Selangor ...	88.5	72.6	80.5	91	70	84	75	84.5	86.9	7.00	177.8	2.60	9	8	1	1	3	234.95	7.83	64
Sitiawan, Perak ...	89.3	72.6	80.9	93	67	82	75	84.3	84.9	4.66	118.4	1.09	8	7				215.75	7.19	58
Temerloh, Pahang ...	89.5	71.8	80.7	93	68	80	74	85.8	86.5	7.54	191.5	2.24	14	12	4	10	1	201.85	6.73	55
Kuala Lipis, Pahang ...	89.4	70.8	80.1	93	68	76	74	84.3	85.1	6.51	165.4	2.04	13	12	2	13	3	199.85	6.66	54
Kuala Pahang, Pahang ...	87.0	73.6	80.3	90	70	81	77	85.6	86.6	6.94	176.3	1.36	19	14			2	215.65	7.19	58
Kallang Aerodrome, S'pore ...	86.1	76.6	81.3	89	72	81	82	83.2	84.5	3.65	92.7	0.82	16	11	1		1	196.95	6.57	54
Butterworth, Province Wellesley ...	87.6	73.6	80.6	91	72	84	76	85.8	86.5	6.69	169.9	4.27	16	13			1	199.25	6.64	53
Bayan Lepas Aerodrome Penang ...	87.8	73.4	80.6	91	71	84	75	84.4	85.1	5.21	132.3	2.15	12	11			3	186.70	6.22	50
Bukit China, Malacca ...	85.5	73.8	79.7	88	70	83	76	84.0	84.9	6.58	167.1	1.65	13	11	4			199.60	6.65	54
Kluang, Johore ...	88.5	71.1	79.8	92	69	79	72	82.3	82.9	5.10	129.5	1.86	14	10	4	8		172.35	5.75	47
Bukit Lalang, Mersing, Johore	87.2	71.8	79.5	91	70	79	75	82.5	82.4	5.18	131.6	0.68	21	17	6	1	2	198.95	6.63	54
Alor Star, Kedah ...	87.7	74.0	80.9	91	72	82	77	86.2	86.8	4.32	109.7	1.70	13	10	1			181.15	6.04	48
Kota Bahru, Kelantan ...	89.1	73.8	81.5	92	70	82	76	84.4	85.1	6.31	160.3	2.07	10	9	3			193.55	6.45	52
Kuala Trengganu, Trengganu	88.3	73.0	80.7	90	69	79	76	83.6	84.8	5.00	127.0	1.30	12	10	5			217.85	7.26	59
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	76.0	63.0	69.5	79	61	69	66	72.3	73.1	4.56	115.8	0.95	16	12	1	10		190.70	6.36	52
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.7	54.5	63.6	76	47	68	62	70.5	70.4	5.00	127.0	1.20	14	14	2		3	191.80	6.39	51
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	72.0	59.3	65.7	76	57	65	61			4.88	124.0	1.26	15	13	2		4	197.55	6.59	53

Compiled from Returns supplied by the Meteorological Branch, Malaya

NOTICE.

Department of Agriculture, S.S. and F.M.S.

The Adviser on Agriculture invites those interested to visit the Central Experiment Station and the School of Agriculture, Serdang, and also the other Experiment Stations, Agricultural Stations, Farm Schools, Padi Experiment Stations, and Padi Test Stations of the Department in various parts of the Straits Settlements and Federated Malay States.

Agricultural Stations and Padi Test Stations also exist in certain of the Unfederated Malay States, to which visits are welcomed by the State authorities.

Intending visitors to the Central Experiment Station should communicate with the Senior Assistant Agriculturist in charge, and to the School of Agriculture with the Principal.

The Central Experiment Station and the School of Agriculture are situated about fourteen miles by road from Kuala Lumpur and three miles from Serdang Railway Station where cars can be hired. Visitors' days at the Experiment Station are the first and third Wednesdays in each month.

Other Stations are listed below together with the addresses of officers to whom enquiries should be sent.

Experiment Station, Tanah Rata, *Agricultural Officer, Cameron Highlands.*

Coconut Experiment Station, Port Swettenham, *The Agriculturist, Department of Agriculture, Kuala Lumpur.*

Pineapple Experiment Station, Lim Chu Kang, Singapore, *Agricultural Officer, Singapore.*

Titi Serong Padi Experiment Station, *Agricultural Officer, Krian.*

Talang Padi Experiment Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*

Pulau Gadong Padi Experiment Station, *Agricultural Officer, Malacca.*

Dairy Farm, Fraser's Hill, *Manager.*

Bukit Mertajam Agricultural Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Selama Agricultural Station, *Agricultural Officer, Krian.*

Kuala Kangsar Agricultural Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*

Cheras Agricultural Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*

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Sungei Udang Agricultural Station, Farm School, and Padi Test Station, *Agricultural Officer, Malacca.*

Kuala Lipis Agricultural Station, *State Agricultural Officer, Pahang, Kuala Lipis.*

Temerloh Agricultural Station, *Malay Agricultural Officer, Pahang South, Temerloh.*

Kuantan Agricultural Station, *Malay Agricultural Officer, Pahang East, Pekan.*

Pekan Agricultural Station and Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*

Ayer Itam Agricultural Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Raub Agricultural Station, *State Agricultural Officer, Pahang, Raub.*

Telok Datoh Agricultural Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*

Labuan Agricultural Station and Padi Test Station, *Agricultural Officer, Singapore.*

Kuala Kurau Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Bagan Serai Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Briah Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Selinsing Padi Test Station, *Agricultural Officer, Parit Buntar.*
Bukit Gantang Padi Test Station, *State Agricultural Officer, Perak, Taiping.*
Lenggong Padi Test Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*
Bruas Padi Test Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*
Sungei Manik Padi Test Station, *Agricultural Officer, Perak South, Teluk Anson.*
Panchang Bedena Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Sungei Haji Durani Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Tanjong Karang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kuang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kajang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kuala Klawang Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
Ampang Tinggi Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
Kendong Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
Dong Padi Test Station, *State Agricultural Officer, Pahang, Raub.*
Kuala Lipis Padi Test Station, *State Agricultural Officer, Pahang, Raub.*
Kerdau Padi Test Station, *Malay Agricultural Officer, Pahang South, Temerloh.*
Bawang Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
Pekan Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
Sungei Blat Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
Glugor Padi Test Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*
Bukit Merah Padi Test Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Unfederated Malay States.

Central Experiment Station, Ayer Hitam, Johore, *Agricultural Officer, Johore Central, Kluang.*
Tangkah Agricultural Station, *Agricultural Officer, Johore North, Muar.*
Gaja Mati Agricultural Station, *Principal Agricultural Officer, Kedah, Alor Star.*
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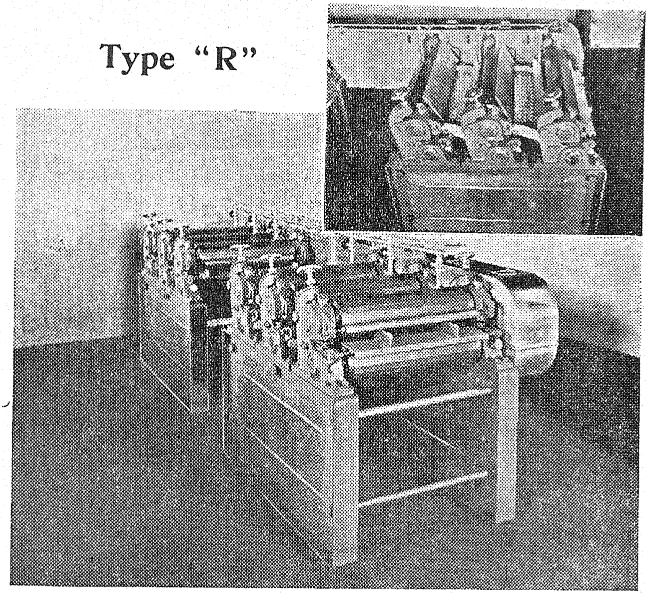

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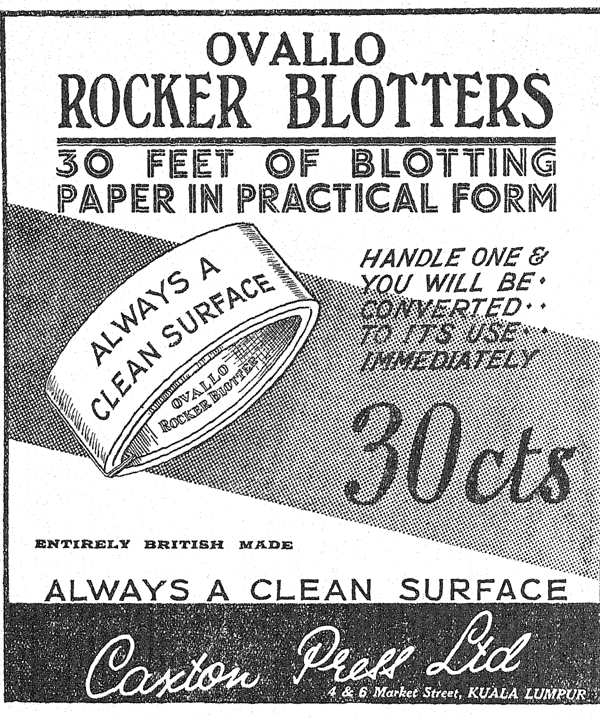
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ERRATA.

Preliminary Selection Experiments with Derris.
Malayan Agricultural Journal, Vol. XXIV No. 8, August, 1936.

p. 381. Table VIII. Heading should read:

Species—*Derris polyantha ?*

Ether Extract of Marketable Roots from Individual Plants at Serdang arranged in Groups of 1 per cent.

p. 388. Table XV, last column, for "14.7 per cent." read "24.7 per cent.", and for "24.7 per cent.", read "14.7 per cent.".

THE

Malayan Agricultural Journal.

SEPTEMBER, 1936.

EDITORIAL.

Irrigation of Coconuts.

Conditions which should ensure the proper development and growth of the coconut palm have been discussed by several authorities on the cultivation of this crop. In an article which we reproduce this month, by Messrs. H. H. Wardlaw and F. R. Mason, Acting State Agricultural Officer, Perak, an account, which merits a careful study, is given of a method of irrigating coconut areas and controlling drainage in order to facilitate the free movement of sub-soil water, one of the conditions favourable to the growth of coconuts. The method described has yielded satisfactory results when applied to an area of dwarf coconuts growing on a comparatively friable soil. In addition to drainage and irrigation, the effect of the cover crop *Centrosema pubescens* on permeability of the soil is discussed, and certain problems regarding the desirability or otherwise of planting covers, and their effect on well irrigated land are suggested as worthy of investigation.

Coffee.

The first record of coffee growing in Malaya, as far as we have been able to ascertain, was in 1779, when a few plants were noticed in a garden in Malacca. The origin of these plants is, however, a matter for conjecture, but it is not improbable that Java was their country of origin. Probably the earliest instance of the cultivation of coffee on a larger scale was that recorded in Singapore in 1822, when it is said to have shown promise, but apparently this optimism proved to be unwarranted, as far as that locality was concerned.

By the year 1881, coffee of the Liberian variety appears to have been definitely established as a plantation crop, and at that time, was being sold for $22 to $25 per picul, the cost of production being $12 to $15 per picul. The reader is reminded that the value of the dollar at that time was 3s. 6d.

The story of the decline in local coffee growing has often been related and was due to fall in prices, insect attack and the superior attraction of rubber planting. There have been sporadic attempts, more especially during rubber slumps to revive coffee cultivation for the local market on a small estate scale and the crop has been under trial at the Central Experiment Station, Serdang, for some years. In this number we print an article by Mr. J. Lambourne, Assistant Agriculturist, in which he recounts the results of experimental work at Serdang. Owing to adverse

soil conditions in the area chosen, results have been disappointing but we desire to emphasise the importance of this article since it provides a warning to those who contemplate taking up coffee growing on the plains, an undertaking which the author makes clear is very liable to bring great disappointment, for although Malaya possesses soils which are better suited for coffee cultivation than those at Serdang, the article clearly shows that a variety of agricultural operations is essential. Maintenance costs are, in consequence, high, so that unless there is a great and unexpected improvement in prices over a period of years, the cultivation of coffee under estate conditions on the plains is unlikely to be remunerative.

The Thirteenth Malayan Exhibition.

The Thirteenth Malayan Exhibition which was held at Kuala Lumpur on the 1st, 2nd, and 3rd of August was opened by His Excellency Mr. A. S. Small, Officer Administering the Government, Straits Settlements, and High Commissioner for the Malay States. In some respects the Exhibition was smaller than that of last year, but the total number of visitors was considerably greater than in 1935. Although most forms of rural industry were represented, it was unfortunate that, owing to the presence of disease, it was not possible to hold the livestock competition.

It is gratifying to record the success of the rubber and padi competitions organized by the Department of Agriculture, S.S. and F.M.S., and that the exhibits were of a high standard which rendered the task of the judges somewhat difficult. This can be ascribed to the fact that lower grades of these products have been eliminated in the numerous local shows which are held during the year.

We are also able to record an increase in the number of entries in the Agricultural Section. In spite of the space provided, overcrowding was noticeable; this might be avoided if, on future occasions, some preliminary selection were undertaken. Another feature of this section which we think could be improved with advantage is the labelling of exhibits, particularly of the lesser known fruits and jungle products which, we noticed, aroused considerable interest. Had the labels been more informative there is no doubt that exhibits of the kind mentioned would have attracted greater attention than they did.

The increasing interest on the part of the public in the breeding of poultry was greatly stimulated by the exhibits in the Poultry Section, and in particular, by those in the special poultry exhibit staged by the School of Agriculture, Malaya. We have no hesitation in saying that this exhibit was one of the most prominent items of the Exhibition.

Original Articles.

AN ACCOUNT OF IRRIGATION AND DRAINAGE CONTROL ON AN AREA OF DWARF COCONUTS

BY

H. H. WARDLAW, A.M.I.E.E.,

late Manager, Chersonese Estate, Perak,

and

F. R. MASON,

Acting State Agricultural Officer, Perak.

The following is an account of a method of irrigating coconut land and controlling drainage, which has been found successful when applied to an area of dwarf coconuts, planted in 1920-21 and which is being put into effect on similar areas of 'dwarfs' recently planted on an estate in Krian, Perak.

It should be mentioned at the outset that the estate in question is exceptionally favourably situated in that a limited quantity of fresh water is available from the Krian Irrigation supply, and that it is realized that only in a limited number of cases will the system described be capable of being followed *in extenso,* but that modifications thereof may be possible.

The method is based on the well known theory that the best results are obtainable from coconuts if the sub-soil water is free to move.

The policy on the estate mentioned above has, for the past twenty years or more, been to put this theory into operation gradually by experiment.

The steps taken, or rather the process of evolution was as follows:—

Firstly. To bund effectively the whole estate and exclude all salt water.

Secondly. The separation of transport and drainage canals.

Thirdly. To maintain the transport canals full of fresh water, and the drainage water in the drainage canals as low as possible by means of water gates connected with the drainage system.

Fourthly. To keep the water in the transport or irrigation canals at a definite level but always moving by means of weirs and water-gates connected with the irrigation system but quite independent of the drainage system, it being essential to obviate "still" or stagnant water conditions.

For many years no change was made in the above arrangement, but it was considered that the irrigation and drainage canals were too far apart for effective irrigation and, although crops showed some improvement and high yields were harvested and maintained year after year, it was decided to experiment with intensive irrigation and the first field to be so treated was one planted with "Dwarfs".

The method and results will be given later in this article.

The following particulars will, it is hoped, enable readers to visualize conditions on the estate.

Situation.

A large block of land in the form of a peninsula bordered by river and sea, all water on sea and river boundaries being salt.

Range of Tides.

The mean range of tides is about 4½ feet which, under the best of conditions, does not permit of more than 3 feet drainage being maintained.

Soil.

The soil is a coastal alluvial clay loam typical of that to be found in Krian and many other coastal areas of Malaya but not as stiff as is to be found in many areas on the Bernam and Perak Rivers.

When first bunded in, but in an undrained condition, the surface soil is grey in colour changing to blue or blue grey a few inches below the surface down to the water table and to an indefinite but considerable depth, and it would appear to the eye to be of a type impermeable to water and therefore not irrigable.

Observations carried out over a period of many years, however, have shown that, given drainage, *i.e.* aeration, a definite change takes place and the soil is proved to be rich in all plant food, and the amount available is limited only by the depth of the effective drainage which again is controlled and limited by the range of tides.

When aerated, this soil loses certain ferrous salts and, assuming it is not subjected to periods of salt water flooding, and drainage is maintained in good order, it should never revert to its former condition of blue clay.

In support of this statement it may be said that canals 5 ft. to 6 ft. deep filled in after the estate bunds were made water-tight, and cut through at right angles and inspected 15 to 20 years later, showed clearly in the blue clay the outline of the original canal, and the filling was still in the condition of top-soil containing humus. In fact, no physical change apart from a darkening in colour appeared to have taken place in the earth filled in.

After drainage and efficient aeration the soil is found to be eminently suitable for the cultivation of coconuts giving high yields.

Water Supply.

Since on the estate in question the river water is salt and unsuitable for irrigation purposes, recourse has had to be made to a controlled amount of fresh water (approximately 1,190 gallons per day) from the Krian Irrigation supply which is connected through a Government syphon box to the estate transport or irrigation canal system.

Details of the Coconut Areas.

The estate is planted with both "tall" and "dwarf" coconuts. The former predominate and some of the fields are known to be at least 35 years old.

The first field containing "dwarfs" was planted in 1920 and these palms have been in bearing since 1925. A statement of yields per acre from this field since that date will be found at the end of this article.

The distance of planting or spacing in the "talls" varies considerably, but in the oldest areas is approximately 28 ft. x 28 ft. square giving 55 palms per acre, and in the later plantings 28 ft. x 28 ft. equilateral triangular system giving about 66 palms per acre. The "dwarfs" planted in 1920 are spaced 22 ft. x 22 ft. square giving 90 palms per acre.

Further large areas have recently been planted with the same varieties, *i.e.* green and yellow "dwarfs", 22 ft. x 22 ft. and also 20 ft. x 20 ft. equilateral triangle. These new areas are mangrove swamp recently reclaimed from the sea by bunding, soil conditions being similar to those throughout the estate.

Drainage and Irrigation.

The interpretation of drainage as applied to a crop such as coconuts does not, in the opinion of the writers, mean the complete exhaustion of water from the soil as is sometimes indicated when discussing drainage in connexion with agriculture in temperate climates.

In the case of coconut cultivation the writers would consider a well drained soil one in which there is a constant soil water movement, but this movement should be very slow, in fact a bare seepage, and by no means of such a nature as to result in washing the soil, as this might prove to be harmful.

This movement or seepage is, however, possible only so long as there is a difference in level between the irrigation and drainage systems, and provided always that the soil is permeable. If no movement takes place then steps should be taken either by additional drains or the planting of suitable covers to rectify matters. A badly drained soil would be one in which soil water movement was non-existent thus giving a "still" or stagnant water table near the surface, conditions under which coconuts will not thrive for long.

The importance of soil water movement for the proper development and growth of the coconut palm, a well known principle enunciated by Copeland (1), Sampson (2), and others, may be illustrated by quoting instances in Malaya where coconuts are found growing in a soil which is to all intents and purposes pure sand, the conditions being as follows:—

In one case on the sandy coastal belt on the island of Penang, in another the sandy coastal belt in Province Wellesley and a third, an almost identical sandy soil of the same origin, in the Dindings, but in the last case forming a ridge some two and a half miles from the coast where accretion in the form of mangrove swamp has taken place between it and the present sea coast.

In the first and second cases the palms grow well and yield heavy crops, whereas in the last case the palms are sickly looking, stunted, and bear little or no crop.

The explanation, as the writers see it, is that in the first case there is high land behind and nothing to impede the flow of soil water from this high land to the sea, passing on its way through the root systems of the coconut palms.

In the second case there is behind the coconuts a considerable area of alluvial clay soil in which wet rice is successfully cultivated and there is a constant movement of soil water from this area through the sandy coastal belt on which the coconuts are planted.

In the Dindings area the sandy belt is slightly higher than the land behind it and there is consequently no soil water movement through it, except that caused by rainfall, and the palms fail to thrive despite repeated manuring and cultivation.

For an irrigation scheme such as is described in this article it is necessary to have an adequate supply of fresh water from an outside source such as a river or stream to maintain the constant movement of water through the soil particularly during the drier seasons.

In the case of the estate described in this article this supply comes from the Krian Rice Irrigation system.

The system of irrigation found most satisfactory provides for a slow but steady movement of soil water through the clay soil described earlier in this article, and is obtained by a series of alternate irrigation and drainage channels or ditches arranged as indicated in Diagram 1.

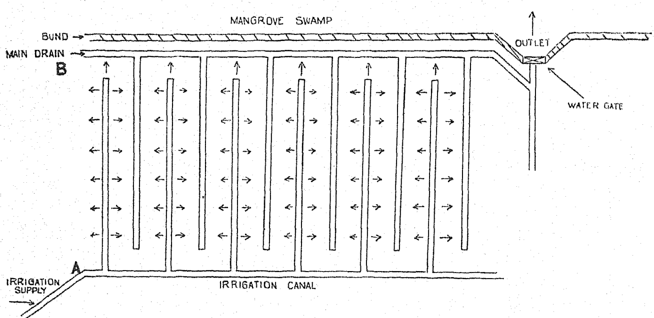

DIAGRAM 1.

Experiments in different soils will indicate the distance these channels should be from one another to give the best results.

The above diagram indicates a simple lay-out and presupposes the necessary fall in levels from the irrigation channel A to the main drain B, when control becomes a fairly simple matter. In cases where there is little or no fall in levels between main irrigation and drainage channels more careful manipulation is necessary.

This is carried out by controlling the level of the water in the main drain so that it is maintained, as far as possible, well below the water in the irrigation channel.

The resulting difference in water level in irrigation and drainage channels causes a steady flow of soil water from the former to the latter as indicated by the small arrows in the above diagram.

Where the supply of irrigation water, *i.e.* fresh water, is unlimited, and the rise and fall of the tide outside the bund and water-gates are sufficiently great, control of water table or level in the drainage system is not difficult, but on the estate described, conditions are difficult and far from ideal due to the following factors:—

1. Irrigation water is limited.
2. The mean range of tides is only about $4\frac{1}{2}$ ft. so that under the most favourable weather conditions little more than 3 ft. drainage is possible and often less.
3. For 6 or 7 days monthly the drainage gates cannot be opened, and, unfortunately, heavy rains often synchronize with these periods.

It has been found that fresh water is essential for irrigation purposes. The estate bunds are maintained in first class order and salt water is in no circumstances allowed to enter the drainage or irrigation systems.

In passing, it should be noted that the internal boundary canal running parallel with the bunds encircling the estate should always be for drainage, and

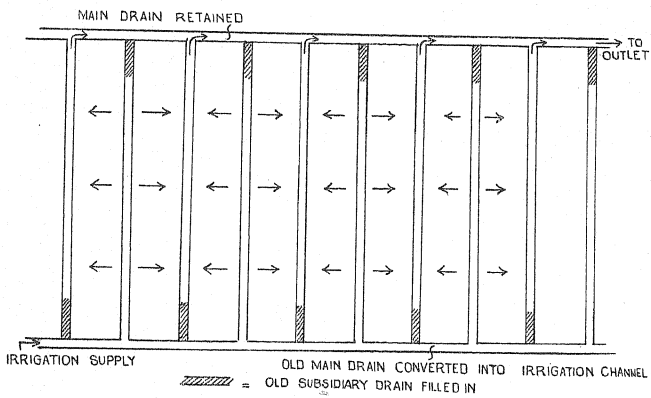

DIAGRAM 2.

the water level kept as low as possible to prevent water logging and a spongy bund, conditions which will in time lead to seepage of salt water through the bund to the drainage system.

In the case of the older area of palms, which was planted and had matured before the system of irrigation described in this article was introduced, the problem of obtaining the necessary drainage or soil water movement was more difficult of accomplishment. Intensive irrigation has however been obtained in such areas by retaining existing drains between rows of palms and utilizing alternate ones as irrigation channels by filling in their extremities for a distance of from 30 to 90 ft. depending on soil conditions, thus cutting off their communication with main drains and finally connecting them up with the irrigation supply.

The diagram on the previous page will help to illustrate the procedure adopted in the case of old areas in which previously nothing but drains existed.

Depth of Drainage for Coconuts.

The question of the optimum depth of the water table for coconuts has always been a debatable point. In the case of the estate described here the depth is limited to an average of about 3 ft. only, due to the low range of tides, but on many estates where conditions are much more favourable, for instance in the case of many estates situated on the Perak and Bernam Rivers, a depth of 5 ft. or more can be maintained. The writers do not, however, advocate this in the absence of irrigation.

If irrigation is in operation, then 5 ft. is considered the maximum depth for the drainage system and rather less if no such system exists and all channels are used as drains. This is merely an opinion and the writers are aware that high yields are at present being obtained from large areas of coconuts with deep drainage.

It should be understood that the above figures refer to the internal or field drains and not to the main drainage system; these main drains obviously need to be 5 ft. to 6 ft. deep. The point to observe is that, generally speaking, the best permanent results are to be expected from coconut areas where the water table is not too low.

Lay-out of Intensive Irrigation System on the new Area.

The clearest way to describe this is probably to assume a rectangular block of land as shown in Diagram 1. Canals are cut on the two longest sides. The size of these canals varies, but on the estate in question 5 ft. deep and 6 or 8 ft. wide is found to be most suitable.

The canal nearest the sea should be for drainage, and the outlet to the sea controlled by water-gates at the most suitable positions.

The other canal will be an irrigation canal connected to any adequate supply of fresh water. Water-gates or weirs should also be connected to the irrigation system to ensure that the water is kept moving.

The required number of 3 x 3 ft. or 4 x 4 ft. channels are then cut parallel to one another and at a distance from each other which must be found by experi-

ment for various types of soil. Alternate 3 x 3 ft. or 4 x 4 ft. channels are connected with the main drainage canal and the others with the irrigation canal.

On the estate described, the most satisfactory dimensions for irrigation and drainage channels between rows of palms have been found to be 3 ft. x 3 ft.

The earth excavated from these channels is used to form a small bank or bund running parallel with and on each side of each channel but about 3 ft. from the edge so minimizing any tendency towards soil erosion and rapid silting up of the channels or drains.

The diagram below illustrates a section through one of these channels and shows details of the construction.

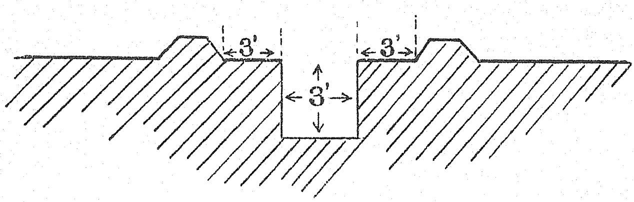

DIAGRAM 3.

It often becomes necessary to carry the irrigation water supply across drains or channels for water-borne transport. This is accomplished by syphoning the drainage water under the transport or irrigation water. Diagram 4 illustrates

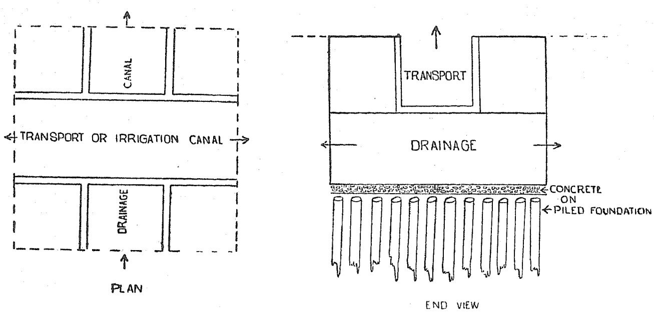

DIAGRAM 4.

the method. A simple description is two boxes built one above the other, the angle of one to the other depending on the position of the drainage and irrigation canals, but usually a right angle.

Spacing of Irrigation Channels and Drains.

This must depend on the nature of the soil and its permeability. In stiff clay soils where permeability is poor, closer drainage would be desirable and cover crops might be expected to ameliorate the conditions.

In the area planted in 1920, where the spacing of the palms was 22 ft. x 22 ft. square, the drainage channels were cut between every 4th row of palms, *i.e.* 88 ft. apart. In 1931 it was decided to introduce intensive irrigation, and alternate drainage channels were converted to irrigation channels; it was found that this distance was suitable for the soil in question, and slow percolation of water took place from the irrigation to the drainage channels. No cover crop was planted and the area was retained under grass close slashed. The results of this work were so exceptional that it was decided to plant two new clearings with "dwarfs" and introduce intensive irrigation shortly after planting.

The details are as follows:—The first block planted in 1935 has an area of 224 acres planted equilateral triangle spaced 22 ft x 22 ft. giving about 103 palms per acre, and the second block to be planted in 1936 will have an area of 100 acres planted equilateral triangle spaced 20 ft x 20 ft. giving about 123 palms per acre.

The distance between drainage and irrigation channels is four rows of palms.

The area will be maintained clean weeded until the palms are 2 to 3 years old and it is then proposed to allow it to revert to grass and keep it close slashed.

A passing note on the equilateral system of planting which may save a lot of trouble is to remember that in order to get the maximum distance from the edges of the channels to the palms, the channels should be cut parallel with the planting base line.

Cover Crops.

Irrigation of coconut areas opens up the question of cover crops and the most suitable type for improving aeration, *i.e.* the permeability of soils, and maintaining fertility.

In 1924 a large number of covers were tried out under similar soil conditions on the estate in question. The leguminous cover plant which showed the most satisfactory growth on mature areas proved to be *Centrosema pubescens* and this cover has now been adopted generally throughout the estate. Many inspections of subsoil conditions have made it abundantly clear that this cover does aerate the soil, and irrigation tests with fresh water that have been carried out prove this contention.

Centrosema pubescens has one great disadvantage and that is that it requires assistance in establishment and it will not kill out grass. Weeding costs are there-

fore increased in coconut areas under this cover but so far as this estate is concerned, it is considered the finest form of cultivation as it opens up the soil in a way that cannot be done by any tool or machine; the increased cost can be considered as cultivation expenditure and is fully justified by results.

On the estate in question, *Centrosema pubescens* has been found to open up the soil to such an extent that the writers consider that experiments to elucidate the following points are worthy of trial:—

1. If the soil can be made permeable by drainage only, is there any advantage in planting covers in areas intensively irrigated or which it is intended to irrigate intensively? This refers not necessarily to questions of irrigation but also to those of soil fertility.

2. If intensive irrigation is introduced to areas which have been for many years under *Centrosema pubescens*, will the water percolate through the soil too rapidly and do harm?

3. Is it possible to increase the yields of 'talls' in the same way as 'dwarfs' by intensive irrigation?

4. Can the size of nuts of 'talls' be increased in the same way as 'dwarfs' by intensive irrigation?

Various methods of cultivation and treatment are being tried out on certain estates in Malaya, where the soil is a very stiff clay, in an endeavour to elucidate some of the points mentioned above.

Yields.

The particulars of the area of "dwarfs" which has given record yields on the estate in question are as follows:—

Area:	41.05 acres.
Date planted:	1920.
Planting distance:	22 ft. x 22 ft. square giving 90 palms to the acre, but owing to the fact that bunds and channels are included in the planted acreage the total number of palms is only 3,488 and the average number of palms per acre just under 85.
Varieties:	Dwarf "red" — 3 palms. Dwarf "greens" — 90 ,, Dwarf "yellows" — 3,395 ,,

Year.	No. of nuts harvested.	Av. No. of nuts per palm.	Copra per acre in piculs.	No. of nuts per picul of copra.
1925	194,530	56	7.83	604
1926	235,360	67.5	9.54	600
1927	209,876	60	7.24	707
1928	386,876	111	14.33	646
1929	235,444	67.5	8.96	602
1930	369,056	106	14.88	592
1931	371,645	106.5	14.93	590
1932	345,208	99	15.18	531
1933	514,091	148	25.99	457
1934	470,028	135	23.56	461
1935	531,219	152	27.60	458

NOTE.—1 picul = $133\frac{1}{3}$ lbs.

Intensive irrigation was introduced in 1931 and fewer nuts were required per picul of copra in 1932. In 1933 and subsequent years, yields have been phenomenally high and the nuts have been very much larger than formerly.

In view of the results already recorded, the writers feel justified in anticipating potential yields of at least 30 piculs of copra per acre from the new area described above planted with "dwarfs" in 1935, and also the area it is intended to plant this year with the same variety making a total of 324 acres.

Similar methods of intensive irrigation were introduced, at a later date, to several areas of 'tall' coconuts but results to date have not been so encouraging, due, in the writers' opinion to the following factors:—

(*a*) The 'tall' palms have been planted very much longer than the "dwarfs" and insufficient time has elapsed for the palms to respond to a change in soil conditions.

(*b*) The areas under 'talls' have been for some years under a cover of *Centrosema pubescens* which has opened up the soil to such an extent that excessive leaching takes place as soon as irrigation water is supplied.

In one field so treated, the water was seen to be passing through the soil so rapidly that the irrigation supply had to be stopped immediately.

It is in view of the above results that the writers advocate further investigation into the effects of cover crops as compared with, say, slashed grass. The writers can see no reason why, with facilities for irrigation supply available, the methods described in this article should not be equally successful when applied to newly planted areas of 'tall' coconuts.

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(1) E. B. Copeland. The Coconut. Macmillan & Co. Ltd., London. 1931.

(2) H. C. Samson. The Coconut Palm. John Bale, Sons & Danielsson, Ltd., London. 1923.

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THE CULTIVATION OF COFFEE AT THE CENTRAL EXPERIMENT STATION, SERDANG

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Introductory.

The cultivation of coffee at the Central Experiment Station, Serdang, was commenced in 1925 when an area of 45 acres of flat land of the type subsequently described as valley quartzite soil was planted. The seeds from which the plants were raised were received from Java and were selected strains of the following species:—*Coffea robusta, C. canephora, C. ugandae, C. quillou, C. excelsa, C. abeokutae,* and *C. liberica.* These different strains were planted with a view to testing their suitability to local conditions and yielding capacity, and also to ascertain the effect of cover crops, green manures and shade.

It was early realized that in consequence of the considerable variation in the soil, the growth of the coffee bushes was uneven. This unevenness increased, and once again confirms the great care necessary when examining land for planting in valleys on quartzite formations (*Malayan Agricultural Journal,* Vol. XVII, p. 179). Furthermore, considerable variation occurred in type of bush and berry within each species and certain of them were found to produce small berries and beans. These two factors have been responsible for the low yields and the disappointing monetary returns obtained. Although there are soils in Malaya which are well suited for coffee cultivation and capable of producing higher yields, it has been decided to publish this article in order that prospective planters may realize not only the difficulties which may be encountered, but also the relatively costly attention which must be given to the crop. In the light of experience gained during the past few years, the production of coffee under estate conditions on the plains must be considered a far from profitable proposition. Unless prices for this product show signs of definite improvement for an extended period, the cultivation of lowland coffee in Malaya is likely to be restricted mainly to small areas of Liberian coffee under Asiatic control in the coastal districts.

Soil.

The land selected is flat, and previous to planting it was under light jungle and included several swamp areas. The jungle was burnt and the land was cleared of all stumps and ploughed and harrowed by tractor power. The soil, as previously stated, is of the valley quartzite type and varies very considerably in different parts from a heavy dark clay through clay loams to dark sandy loams. The land was thoroughly drained before planting.

Planting.

The seeds were sown in September 1934, in nursery beds, and the seedlings were planted in the field about a year later, *i.e.* between October 1925 and January 1926. All varieties of seedlings were planted 10 ft. by 10 ft. square.

Good growth was made over a large part of the area but there were patches of soil on which growth was poor. Supplying and manuring in these areas were carried out, but the plants have never been vigorous. These patches are, in general, associated with the occurrence of acid shales close to the surface.

During 1930, the five acres of *Coffea quillou* were removed owing to the fact that this variety was more badly infested with the coffee berry borer (*Cryphalus hampei*) than the other varieties, and appeared to be a source of infestation to the other areas. *Coffea quillou* was replaced in 1931 by *C. Dybowskii*, a Java hybrid of Liberian type somewhat similar to *C. excelsa*.

Cover Crops and Green Manures.

In April 1926, the whole area was divided into nine strips running east and west, and so arranged that there should be approximately half an acre of each variety of coffee in each strip under cover crop or green manure, and one acre under shade trees. The strip of shade trees was planted along the middle of the area with a strip of each cover crop or green manure on either side. The cover crop used was *Calopogonium mucunoides* and the green manures were *Tephrosia candida* and *Crotalaria anagyroides*. The shade trees first planted were a broad-leaved species of *Albizzia* interplanted with *Gliricidia maculata* and later one or two trees of *Albizzia moluccana* were planted at the western end of the area.

After *Calopogonium mucunoides* had been established for some time, it was found to be retarding the growth of the coffee plants and causing the leaves to turn yellow, in spite of the fact that a circle with a radius of 3 feet round each bush was kept clear of the cover crop. As the *Calopogonium* continued to harm the young bushes it was turned into the soil, and the area has since been kept clean-weeded. The *Tephrosia candida* and *Crotalaria anagyroides* were pruned every three months and the prunings were worked into the soil on the plots in which they were growing. The green manures were removed in March, 1928. The *Crotalaria* plots were afterwards kept clean-weeded, but the *Tephrosia* plots were sown with *Leucaena glauca* (Lamtoro). The latter never made very vigorous growth, but a number of the plants still remain and form a light ground shade. *Albizzia* sp. made poor growth as did most of the *Gliricidia maculata* trees, consequently shade was negligible for some years, and even now is not satisfactory.

Manuring.

It was intended to conduct a series of manurial experiments over the area, but this was dropped owing to irregularity in soil conditions. Fertilizers were applied from time to time when the appearance of the bushes suggested the advis-

ability of manuring. Lime also was applied, and an attempt made to ascertain its effect by comparison of crop yields with those from unlimed areas. In September 1930, slaked lime at the rate of 10 piculs per acre (1 picul = 133 1/3 lbs.) was applied to the northern half of the area, followed in October 1930, by a dressing over the whole area of sulphate of ammonia at the rate of 50 lbs. per acre. During February 1931, a complete mixture of chemical fertilizers was given, consisting of sulphate of ammonia 50 lbs., superphosphate of lime 300 lbs., and sulphate of potash 150 lbs., per acre.

No manures were applied in 1932, but during the period June to September 1933 a dressing consisting of rock phosphate at the rate of 3 cwts. per acre and sulphate of potash ¼ cwt. per acre was applied, all weeds and dead leaves from beneath the bushes being buried in trenches between the rows at the time of application. The same manures in the same quantities were applied again in December, 1934. These were spread around the bushes and worked into the surface soil during the weeding round.

The mean annual yield of fresh cherries harvested from the limed and unlimed areas shows that, on the whole, the limed area yielded heavier crops than the unlimed area. This was more marked with certain species than with others, but owing to soil irregularities the results are inconclusive.

Pruning.

Pruning was carried out according to the "single stem method". The bushes were topped at 5½ feet and all suckers were removed from the main stems as they appeared. The primary branches were allowed to grow, and secondary branches were thinned so as to allow light to all parts of the bush, whilst still retaining the maximum of fruiting branches.

Thinning of secondary branches applies more particularly to the Liberian types, for the robusta types do not develop so many secondary branches. It has been found that several of the primary branches in the robusta types break close to the main stem especially when bearing large crops of fruit, and it has been necessary to remove them and provide, where possible, for new growth to take their place.

Effect of Green Manures and Shade.

As already stated, *Calopogonium mucunoides* had the effect of retarding growth and causing the coffee plants to assume a yellow and unhealthy appearance. The tall legumes (*Tephrosia candida* and *Crotalaria anagyroides*) caused the coffee plants to be drawn up too quickly unless the former were kept pruned. As regards yields of fruit, the cover crop, green manures and shade all appear to have had an adverse effect, for, on the average, the clean-weeded plots have produced the highest yields. The form of lay-out of the experiment does not lend

itself to statistical analysis, and it is therefore impossible to say whether the differences are significant. Further, as the soil varies considerably within blocks, and the growth of the bushes has been correspondingly uneven, it would not be wise to draw any definite conclusions from the records of yields.

The shade tree area has yielded on the whole less than the other areas, but this may be due to competition and inadequate shade, for, except in patches, the trees have not given satisfactory shade to the bushes. Where there is shade from one or two *Albizzia moluccana* trees the bushes are a more healthy green but appear to bear less fruit than those in the full sun. Nothing definite can be said regarding the merits of shade until further experiments have been carried out. In this respect, not only the effect of shade on the bushes but density of shade and the most suitable tree for the purpose require to be investigated. *Gliricidia maculata* has been planted in part of the Dybowskii coffee area and is giving a light shade which appears ideal, but the yield of fruit for the first year is smaller from the shaded than from unshaded areas. Since there is only one plot under shade, and it is the first year the bushes have borne fruit, nothing definite can be said regarding the merits of this type of tree as shade for coffee.

Planting Distances.

The planting distance of 10 ft. by 10 ft. which was adopted for all varieties, is too wide for the robusta types and the Liberian type has become over-crowded. *Coffea liberica, C. abeokutae* and *C. Dybowskii* require planting at 12 ft. by 12 ft., and *C. excelsa,* which has a wide-spreading habit, could very well be planted at 14 ft. by 14 ft. The distance of planting is important since, when too closely spaced, branches of adjacent bushes interwine and impede those engaged in inspecting or in harvesting the fruit. On the other hand if spacing is too wide, considerable areas of soil are unshaded, and the growth of weeds is encouraged. As the coffee bush has very shallow roots it is essential that the soil should be shaded to keep it cool thus preventing rapid evaporation and conserving fertility. Moreover, frequent weeding with the changkol is liable to damage the feeding roots. According to the experience gained at Serdang, low cover crops among coffee are undesirable.

Diseases and Pests.

The coffee bushes, more especially the robusta types, have been subject to a die-back of the branches, often after they have borne a heavy crop of fruit. The primary branches have also broken close to the main stem. The die-back is accompanied by yellowing or chlorosis of the leaves.

As is usual on the plains the coffee leaf disease (*Hemileia vastatrix*) is nearly always present, but it appears to do very little damage to the bushes at Serdang.

A few bushes of *Coffea abeokutae* were attacked by "Thread Blight", a fungus, the white mycelium of which spreads over the leaves and branches. This

occurred in a small patch of bushes and was treated, on the advice of the Mycologist, with a proprietary sulphur spray which cleared it up in a comparatively short time. The disease did not spread and there has been no recurrence.

The coffee berry borer (*Cryphalus hampei*) has been prevalent, more especially in the robusta types. All the Quillou coffee was cut out in 1930 because it was so badly infested by this borer. These small beetles cause damage by boring into the beans causing considerable loss of crop by their depredations. In Malaya, where there are always fruits upon the bushes, the berry borer is not easily controlled once it has become established. The incidence of attack can be diminished by harvesting frequently all ripe and black berries. During the past year this pest has done comparatively little damage to the Liberian types and in the robusta types the incidence of attack has diminished considerably.

Harvesting.

Although a few fruits ripened during the latter part of 1927, regular harvesting and recording of yields were not commenced until March, 1928. There are no distinct fruiting and resting seasons with coffee at Serdang although the largest proportion of the crop is harvested in April and May, and November to January.

The varieties *Coffea canephora, C. robusta,* and *C. quillou* produced ripe fruits in two years and nine months from seed, and at one and a half years after planting in the field. *C. ugandae* was approximately three years old, *C. abeokutae* and *C. excelsa* three years and two months and *C. liberica* plants three years and nine months old from seed when the first fruits were ripe. Records show that flowers appear at frequent intervals throughout the year and that all the varieties flower on or about the same day. Consequently the bushes contain ripe fruit almost continually and a fortnightly harvesting round is essential, otherwise there is considerable loss of crop.

Yields.

The yields of coffee from these areas have been disappointingly low owing to several causes. The soil is of low fertility and varies considerably over the area, consequently the growth and productivity of the bushes have been affected.

The robusta types of coffee are more susceptible to die-back and attacks from the coffee berry borer than the Liberian types, consequently these types have not yielded so well as *Coffea excelsa* and *Coffea abeokutae,* which are comparatively free from die-back and are not so heavily infested with the berry borer.

Yields of coffee berries per acre from the different varieties and plots in the area are recorded in the following table.

Table I.

Average Yields of Coffee Berries per acre per annum.
Period 1928—1935.

Variety		*Calopogonium mucunoides*	*Tephrosia candida*	*Crotalaria anagyroides*	Clean Weeded.	Shade Tree	Mean Yields
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
				Robusta	Types		
Canephora	1-03 ...	985	988	978	—	—	983
,,	No. 1 ...	1,080	1,093	907	1,158	1,007	1,049
,,	No. W1 ...	514	621	744	1,267	774	784
Robusta	59-01 ...	1,062	1,002	1,006	—	—	1,023
,,	78 ...	594	821	709	1,029	766	784
*Quillou	66-04 ...	676	1,059	954	1,390	657	947
Ugandae	1-02 ...	619	912	864	1,141	1,517	1,011
,,	2 ...	1,068	1,034	761	1,006	1,118	997
				Liberian	Types.		
Abeokutae	No. ZZ ...	2,119	2,510	2,565	3,480	2,070	2,544
Excelsa	121-10 ...	2,665	2,811	2,657	3,431	1,634	2,640
,,	...	2,669	3,018	3,322	3,909	3,313	3,252
Liberica	No. 1 ...	1,004	1,149	911	1,148	979	1,038
Dybowskii	(1935 only)	1,485	1,813	1,732	1,760	1,290	1,616

* 1928-1930 only.

The proportion of fresh berries to prepared dry beans was recently determined from a number of samples (Table II). The results agree closely with those published in the *Malayan Agricultural Journal*, Vol. XVIII, p. 481.

The crop increased each year from 1928 to 1930, but in 1931 yields decreased considerably. There was a gradual increase during the next two years (1932 and 1933) with a decline again in 1934 and a partial recovery in 1935. The application of a complete mixture of fertilizers in February 1931 does not appear to have had much effect on yields during that year but may have helped to increase the crop in 1932 and 1933. During the latter half of 1933 rock phosphate

Table II.

Proportion of Fresh Berries to Dry Beans by weight

Liberica	...	10 of berries to 1 of beans.		
Abeokutae	...	10	,,	,,
Dybowskii	...	7.5	,,	,,
Excelsa	...	7.5	,,	,,
Robusta	...	5	,,	,,
Canephora	...	5	,,	,,
Quillou	...	4.5	,,	,,
Ugandae	...	4.5	,,	,,

and sulphate of potash were applied and the leaves and weeds buried in trenches between the rows of bushes; whether this was responsible for decreased yields the following year or whether the latter are due to a cycle in the life of the bush or to weather conditions, it is difficult to say. There has been a peak of production followed by a sudden drop every third year. It is possible that the lime was responsible for depressing yields in 1931 and that the burying of leaves and weeds in 1933 affected the 1934 yields.

In the following table the actual costs incurred are recorded together with the revenue obtained from the coffee harvested, based on the yields secured for the two types of beans. The costs at Serdang are somewhat higher than they would be under estate conditions on account of experimental work, the cost of which cannot be separated from essential charges. Owing to the numerous small plots and different treatments, costs of harvesting always amounted to a high figure. Expenditure has been greater than receipts. *Coffea excelsa* is the only variety that has approximately paid for the upkeep of the area on which it is planted but there is no margin for interest on capital.

The initial costs per acre are as follows:—

Felling	$ 8.00
Burning	2.00
Clean clearing	45.00
Draining	15.00
Ploughing and harrowing	15.00
Lining	1.00
Holing	24.00
Planting	6.00
Supplying	7.00
Sowing cover crops	1.50
Pruning green manures (initial cost)	2.00
Planting shade	2.00
Total ...	$128.50

The following table shows the annual expenditure in upkeep, harvesting and preparation of coffee for market.

Table III.

Annual Expenditure per acre for Upkeep, Harvesting and Preparation for Market.

Operation.	1925 to 1928	1929	1930	1931	1932	1933	1934	1935
	$	$	$	$	$	$	$	$
Weeding	127.51	26.26	21.44	28.25	19.32	24.20	30.30	22.88
Upkeep of drains	7.31	3.88	2.16	2.61	1.53	1.23	1.64	1.08
Pruning	12.53	6.49	8.01	10.09	7.78	7.16	7.48	4.80
Application of manures		.72	.36	3.14	.34	5.03	3.08	
Manures			8.42	17.82	18.00	8.25	8.25	
Pests and diseases	2.36	7.17	.31	.55	3.65	2.21	2.05	4.07
Replanting					14.52			
Harvesting	5.88	22.63	32.26	22.88	17.62	11.58	22.45	20.04
Manufacture		4.81	4.81	4.81	4.81	4.81	4.81	5.07
Total $	155.59	71.96	77.77	90.15	87.57	64.47	80.06	52.94

Table IV.

Average Revenue per acre.*

Variety	1925 to 1928	1929	1930	1931	1932	1933	1934	1935
	$	$	$	$	$	$	$	$
Robusta types	19.22	48.07	28.44	13.14	32.42	34.04	27.07	43.93
Liberian „	11.07	42.32	42.05	19.17	64.00	87.06	62.00	59.44

* Calculated.

Summary and Conclusions.

1. Various strains of coffee were planted with a view to comparing their merits and to ascertain their suitability for cultivation at the Central Experiment Station, Serdang. It was early apparent that the soil in this particular area was infertile and varied considerably throughout the block and this was reflected in the growth of the bushes and subsequent yields of coffee.

2. *Calopogonium mucunoides* as a cover crop among young coffee has a retarding effect on growth and causes the leaves of the plants to turn yellow.

3. The cover crops, tall leguminous plants and shade trees all appear to have had an adverse effect upon the yields of coffee, but it would be unwise to state definitely whether this is the case owing to the conditions under which the experiment was carried out.

4. Lime appears to have had little effect on yields but the fertilizers may have been responsible for maintaining yields, although at a low level.

5. Planting distances and methods of pruning are factors affecting yield, since the largest number of fruiting branches possible per acre without over-crowding is necessary if the maximum crop is to be obtained. Coffee has a shallow root system and, when spacing is too wide, weeding costs are high and there is disturbance of the roots at each weeding; also more of the soil is exposed to the sun which results in loss of fertility.

6. Variation occurs with each strain of coffee in respect of habit of growth, size and colour of berry, size of bean and yield. This is of course common in any population of seedlings unless special care is taken to obtain seeds from bushes of fixed type growing in an isolated position. Variation can be partly overcome by vegetative propagation from selected bushes but does not entirely solve the problem.

7. The dying back of branches and damage done by the coffee berry borer (*Cryphalus hampei*) caused considerable loss of crop especially from the small-berried type *i.e. Coffea robusta, C. canephora, C. ugandae* and *C. quillou.* The

coffee berry borer can be partly controlled by harvesting fortnightly all ripe and black berries. The incidence of this pest has greatly diminished during the past year.

8. Yields have been low owing to the causes mentioned above and in consequence none of the varieties, with the possible exception of *C. excelsa*, has produced sufficiently large crops to pay for the upkeep of the area. It should be recorded that prices have been very low during the greater part of the time these areas have been in bearing.

9. The conclusions enumerated above show the importance of selecting suitable land for coffee cultivation, and instance the necessity, previously pointed out, of avoiding the infertile soil frequently occurring in valleys on quartzite formations.

10. Although the costs recorded cannot be taken as exact criteria for the reasons given, it is considered that prices ralized for lowland coffee during the past few years have been so meagre as to render its production unprofitable under estate conditions.

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THIRTEENTH MALAYAN EXHIBITION

BY

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Assistant to Agricultural Economist and Editor.

The Thirteenth Malayan Exhibition, organized by the Malayan Agri-Horticultural Association, was held in Kuala Lumpur during the August Bank Holidays, the 1st, 2nd and 3rd August, 1936. Exceptionally fine weather again prevailed throughout the Exhibition, and the total number of visitors, 46,914 (including ticket-holders) far exceeded the 1935 total of 30,036. In 1934 the total was 22,588, and in 1933 20,093.

Although the Exhibition was actually smaller from the point of view of stall-holders and certain of the competitive sections, the accommodation provided was not reduced, so that the larger crowds of sightseers were able to circulate with moderate ease.

The Association was fortunate in obtaining two additional permanent buildings which enabled a change to be made in the lay-out adopted in previous years. In addition a permanent porch was erected of timber and shingles supplied by the Forestry Department, and a large space in the main building was reserved as a resting place, surrounding a fountain playing in an attractive lily pond.

The Opening Ceremony.

His Excellency Mr. A. S. Small, Officer Administering the Government, Straits Settlements, and High Commissioner for the Malay States, declared the Exhibition open at 11 a.m. on the 1st August, in the presence of a distinguished gathering which included H.H. The Sultan of Pahang and suite, H.H. The Raja Muda of Selangor, the Hon'ble the Undang of Rembau, and the Hon'ble the British Residents of Selangor, Pahang, and Negri Sembilan.

Mr. F. W. Douglas, President of the Malayan Agri-Horticultural Association, in calling upon His Excellency to open the Exhibition, commented on the fact that the area now occupied by buildings was twice that of the 1930 Exhibition. He also drew attention to the large increase in the number of District Shows. After referring to the reduced Trade Section which he considered due to a wave of pessimism which had crept over trade in Malaya, Mr. Douglas went on to appeal to Government to assist the small-holder to obtain the benefit of cheap money by taking over control of pawnshops and by some form of land bank.

In conclusion, Mr. Douglas said:

> "I would like to place on record today the very great sense of loss which this Association felt owing to the departure of Dr. Tempany. His drive and co-operation were always an inspiration to us.
>
> It remains for me to express our thanks to the small army of voluntary workers who come to our aid every year. The success of our Exhibition depends on the work of so many people whom we are too apt to overlook because we so often only see the exhibit and forget the amount of trouble others have been put to. To all of these I can merely say—'Thank you'."

His Excellency, Mr. A. S. Small, reviewed the more salient features of agricultural conditions in Malaya during the past year. He said, *inter alia,*

"Thanks to the rubber regulation scheme, the rubber industry has shown a welcome recovery from the dark days of the slump. The scheme has worked smoothly and well, and during the last twelve months it has brought about a steady reduction of surplus stocks which has naturally resulted in a gradual rise in price to a figure which enables most properties to show a moderate profit.

Confidence in the future of the industry is being gradually restored, and this is indicated by the extent to which the owners of rubber properties are taking advantage of the provisions of the Rubber Regulation Enactment to replace the permissible percentage of old and less profitable rubber trees with new budded plants from high-yielding clones.

The Rubber Research Institute has continued to render valuable service to the industry. In addition to meeting numerous calls for advice in connexion with replanting programmes on estates, it has not neglected the needs of the small-holders. Since May, 1934, it has been building up a service of Asiatic instructors, to which four more officers have been appointed this year, bringing the total to 17. The value of the work of these instructors is well illustrated by the marked increase in the number and improvement in the quality of the exhibits of small-holders' smoked sheet which were to be seen this year at the local competitions and District Shows, constituting the first stage of the All-Malayan Rubber Competition. The winning exhibits in the first stage have been assembled at this Exhibition for the final stage, and you will be able to judge of their quality for yourselves by visiting the Rubber Research Institute's building. The small-holders' rubber smoking cabinets, which have been designed in various very cheap materials by the Rubber Research Institute and have been widely demonstrated throughout the country, have played a considerable part in rendering possible the progress made during the past year.

Coconut and Oil Palm.

"The position in the coconut and oil palm industries has fluctuated somewhat, but at present shows some improvement on that of a year ago. With increasing production of copra and other sources of vegetable oils, the general tendency is for supplies to exceed demand and for competition to remain severe. Other more temporary factors have, however, influenced prices. Thus the processing tax in the United States has encouraged the production of certain oils, formerly of little importance, such as sunflower seed oil, because they have been able to enter that country free of duty. Another effect of this tax has been to divert the Philippine copra supplies to the European markets, and the effect of this competition has been to depress the price of Netherlands Indies and Straits copra in Europe. On the other hand, there has been a considerable demand for glycerine, much of which is made from coconut oil, and this tended to strengthen prices. The shortage of supplies of animal fats and the increased demand for oil cakes caused by the drought in the United States last year also tended to improve the price of copra, and this year's drought already seems to be having a like effect. Finally, an agreement which seems likely to be reached between Norway and the United Kingdom, limiting the production of whale oil during the present season, would also be a favourable factor.

Welcome progress has been made towards improving the marketing side of the industry. At last year's Exhibition it was announced that a Vegetable Oils Section of the United Planting Association of Malaya was in process of formation. The Department of Agriculture has submitted to it a scheme for the voluntary production and marketing under a Malayan Mark of a special grade of Straits copra. The scheme is based on the National Mark Scheme in the United Kingdom, the mark being the producers' guarantee that the product conforms to certain defined standards of quality. It is proposed that this scheme should be instituted on an experimental basis in the first instance in order to ascertain if there is a demand for the improved product at a profitable increase in price.

Copra Drying Cabinets.

"The Officer-in-Charge of Copra Investigations in the Department of Agriculture has also designed a series of copra drying cabinets, capable of producing copra of the best quality in less than 24 hours, for use on holdings of different acreages. They are all constructed of cheap and readily obtainable materials. Two will be on view outside the Department's building in this Exhibition. These cabinets have already attracted much attention wherever they have been demonstrated and have begun to produce their effect on the quality of the small-holders' copra. The improvement in the quality of this product that has taken place in the last three years has been very evident at District and State Shows. Recent reports from the Agricultural Officers in different parts of the country indicate that this improvement in quality is becoming widely recognised by exporters and is resulting in a definite improvement in the price obtained by small-holders.

Another advance that has been the outcome of recent propaganda is the installation in at least two coconut oil factories of refining machinery by means of which a very high-grade coconut oil is being produced.

Pineapple Industry.

"In the pineapple canning industry there has also been marked progress. Canning factories have been much improved and now conform to accepted standards of hygiene and sanitation. A canning officer joined the staff of the Department of Agriculture at the beginning of the year and has now received all the plant needed to enable him to commence his investigation work. Since his arrival he has established close contact with all the canners and been able to render them useful advice and assistance. Under his advice the canners have agreed to the gradual introduction of five standard sizes of cans in place of the numerous different sizes now in use. The Department of Agriculture has drafted and submitted to Government a scheme for the introduction, with the approval of the industry, of a Malayan Mark voluntary grading scheme for canned pineapples, which, like the copra scheme, is based on the National Mark Scheme in the United Kingdom.

The Rice Crop.

"The final estimate of last season's rice crop is not yet available, but the figures already received indicate that it will be as good as, and probably better than, that of the previous season, though not up to the bumper crop of the season 1933-34. The Kedah crop was the largest ever recorded in that State, but unfavourable weather conditions reduced the yield in other parts of the country, notably in Province Wellesley and Krian.

Much has been done in the improvement of rice cultivation and in the settlement of new areas, such as those of Sungei Manik in Perak and Panchang Bedena in Selangor. The All-Malayan Padi Competition, now in its third year, has again been well supported and its effect on the quality of the exhibits will be evident at this Exhibition. Efforts to improve the yield and strain of the rice grown in Malaya have been continued and the three special officers appointed to the Department of Agriculture for rice research have now been at work for a year.

Tuba Root (Derris).

"There has in recent years been a growing world demand for insecticides of vegetable origin which are comparatively harmless to man and the higher animals, to replace the more dangerous arsenical preparations. For this reason interest in tuba root has been well maintained on the world's markets. Tuba root has certain important rivals, notably the Cubé root of South America. Both plants show very marked variation in their toxic content according not only to the variety, but even the strain of each plant. The Department of Agriculture has been vigorously conducting investigations with tuba root and is now attempting to produce clones of high toxic content exactly similar to the now well known clones of high-yielding rubber trees."

The Hon'ble Mr. F. W. South, Acting Adviser on Agriculture, and a Vice-President of the Association, thanked His Excellency for opening the Exhibition, and took the opportunity of paying a tribute to the work of Lieut.-Colonel B. J. Eaton, O.B.E., the retiring Director of the Rubber Research Institute of Malaya.

The Exhibition was divided into three main groups: competitive sections, Government departmental exhibits, and the trade section.

Competitive Sections.

All-Malayan Padi Competition.

The All-Malayan Padi Competition inaugurated in 1934 is now well-established and has become largely a matter of routine. As explained in previous issues of this Journal,* the best samples from local Shows throughout the country are submitted for the Central Competition at the Malayan Exhibition at Kuala Lumpur in the ratio of three entries for every 10,000 acres of wet padi in each District or State.

State Shows, District Shows and local Padi and Rubber Competitions were held at forty-two centres during the several months preceding the Exhibition. The table below shows the distribution of these local Shows in the various States.

	State Shows	District Shows	Padi and Rubber Competitions
Kedah	1		
Penang / Province Wellesley ...	1		4
Perak	1†	3	15
Selangor		5	5
Negri Sembilan		3	1
Malacca		2	1
Johore	1	3	1
Pahang			5
Kelantan	1		
Total	5	16	32

In the Central Competition, every State in the Peninsula, with the exception of Perlis and Trengganu, was represented. The total number of entries received was 139 distributed as follows:—Kedah 22 (17), Penang 3, Province Wellesley 9 (9), Perak 42 (39), Selangor 16 (15), Negri Sembilan 14 (12), Malacca 11 (12), Johore 3 (3), Pahang 17 (19), Kelantan 2 (—). The figures in brackets are for 1935, (total 126).

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* *Malayan Agricultural Journal,* Vol. XXI No. 12, December, 1933, Vol. XXII No. 6, June 1934, Vol. XXIII No. 9, September 1935.

† Perak State Padi and Rubber Competition.

As may be seen from the table, there was a small increase in the number of exhibits submitted for the final competition, although the number of original entries from which the final selections were made was, as in 1935, probably about 5,000.

The high standard of previous years was well maintained and there was a large number of entries with which little fault could be found. Preliminary selection reduced to fourteen the number of exhibits in the running for the six prizes, and these were judged on a basis of marking similar to that used in 1935 except that marks for "type of grain" were not allotted except in differentiating between two otherwise equal entries. Thus, with a possible maximum of eighty, marks were allotted as follows:—

1. Purity of sample	30
2. Condition and uniformity of ripeness	20
3. Condition and uniformity of grain	10
4. Weight per unit volume	10
5. Cleanness of sample	10
	80

Two exhibits tied on marks for first place with 78, but the first prize was finally awarded to an exhibit of Radin 13 from Raub (Pahang) as being a variety superior to the Nachin 756 from Sabak Bernam (Selangor) with which it was equal on other characters. The third prize went to Perak for a pure strain Radin and the fourth to Malacca for a good exhibit of Siam 29. Fifth and sixth prizes both went to Negri Sembilan. A special prize was awarded to the 22 exhibits from Kedah as a group. Although winning no individual prizes, this State put up a very good selection of varieties suitable for milling, and as such varieties are of great importance to Kedah it was considered that the entry deserved recognition.

All-Malayan Small-Holders' Rubber Competition.

This competition was inaugurated at last year's Exhibition, and is based on the Padi Competition, selected prize winning exhibits from District Shows being finally judged at the Central Competition at the Exhibition.

This year, entries were restricted to exhibits of smoked sheet only; with cheap and efficient smoke houses now available it was felt that there was no longer any point in admitting air-dried sheet to the competition. The object of much recent propaganda has been to encouraging small-holders to smoke their sheet, and thus obtain a higher price, and this object would be countered if prizes continued to be given for air-dried rubber.

Each entry consisted of three sheets, and a total of 97 entries was received, as follows: Perak 22 (nil), Selangor 17 (20), Negri Sembilan 11 (12), Pahang 13 (3), Malacca 6 (1), Province Wellesley and Penang 8 (6), Johore 20 (12). The figures in brackets are the 1935 entries. Perlis sent three exhibits in 1935, but did not compete this year.

Judging was carried out on the same basis as last year, but, owing to the extremely high standard of quality reached by the exhibits, 100 points were the accepted maximum instead of 10 points, thus rendering possible finer discrimination in judging.

The scale of points was as follows:—

Freedom from over-smoking	10
Evenness of colour	10
Thickness	10
Freedom from:	
Mould and oxidation marks	20
Rust, bubbles and shortness	20
Specks and sand	30
	100

The exceptionally high standard reached by all exhibits rendered judging extremely difficult, and only by penalizing heavily quite minor flaws was it possible to grade the first six exhibits which were selected as follows: 1st Pahang 96, 2nd Negri Sembilan 95, 3rd Selangor 89, 4th Pahang 88, 5th Pahang 82, 6th Johore 80.

The judges commented on the fact that many of the exhibits which failed to win prizes were of first class quality, and there is no doubt that the competition has proved an unqualified success.

Agricultural Section.

The Agricultural Section was again housed in a large temporary building on the left of the main entrance.

The total number of entries received was 5,118, which represents an increase when compared with 5,155 in 1935, as the oils and fats classes were treated as a separate section this year.

The outstanding exhibit was again the collection of fruits and vegetables entered by the Cameron Highlands Society. So good was this exhibit that it was decided to award a gold medal as a special prize.

The large number of entries inevitably tended to overcrowding in spite of the generous size of the building allotted to the section, and the excellent results obtained as a result of the procedure adopted in the padi and rubber competitions would appear to indicate that some form of preliminary selection is advisable in the agricultural classes.

Oils and Fats Section.

This section, which was displayed at the end of the main building, replaced the Special Coconut Section which was a feature of the 1935 Exhibition.

Coconut oil and copra formed the principal exhibits, and although entries were not as numerous as last year, the quality of the exhibits shewed clearly the results of the work of the Department of Agriculture in encouraging the small-holder to produce good copra.

Entries of estate copra were as large as previously and maintained a high standard.

A feature of the section was the large number of locally-made soaps, most of which were attractively packed and of exceptionally good quality.

Other Competitive Sections.

The usual other competitive sections were organized on lines similar to those of previous years. One of the new permanent buildings was allotted to the Horticultural Section. The display of plants and flowers was one of the best staged in recent years, and great credit is due to the section secretary.

The other new permanent building housed the Preserves and Confectionery, Art and Photography, and Needlework Sections, and a school exhibit of handwork. In the first mentioned section there was a notable improvement in the quality of preserved fruits in syrup; a high standard was reached by several of the exhibits in the art section.

The Village Industries and Schools building provided, as usual, one of the most interesting sections of the Exhibition. Selangor and Kelantan both had State stalls, and exhibits from Trengganu were included in the latter stall.

Unfortunately the incidence of disease in Kuala Lumpur District made it impossible to hold the cattle and pig competitions, but the poultry section was organized as usual, although the number of exhibits appeared considerably lower than in recent years. The Cat Section, was held on the last day of the Exhibition, and here again, entries were rather fewer in number than formerly.

Department of Agriculture, S.S. and F.M.S.

A comprehensive exhibit was staged by the Department of Agriculture, covering copra, pineapples, rice, and Derris (tuba root).

High-grade copra was shewn, produced on the new types of high-speed kilns which have been erected and operated at the Coconut Experiment Station, Port Swettenham. There was also a collection of products manufactured from the coconut illustrating the many wide commercial uses to which this crop may be put. A display of coir articles was especially interesting since, in this country, little is produced and that little is of extremely poor quality. Two kilns of the new type were erected in the grounds.

The pineapple exhibit demonstrated the work which is now being undertaken to improve the quality of Malayan canned pineapples and to secure and extend the market for them.

Numerous examples demonstrated the work on selection which is in progress at the Pineapple Experiment Station, Singapore, to produce an improved type of pineapple for canning. There were, also, examples of graded canned pineapples demonstrating the proposed Malayan Mark Grading and Marketing Scheme, and many illustrations shewing the work which is being undertaken at the newly established pineapple canning research station.

Padi and rice exhibits were staged primarily with a view to instructing the padi-growing small-holder. They were in three sections shewing (1) milling of rice, (2) samples of pure strain varieties selected by the Department of Agriculture, and (3) typical faults in samples sent to local competitive shows.

The exhibit of Derris was designed to illustrate the production and uses of this root. The dry root was displayed, together with some of its products, including rotenone, the white crystalline toxic ingredient; other less-known derivatives and extracts were also shewn. The insect pests of tuba root exhibited shewed clearly that Derris poisons are not fatal to all insects.

An interesting exhibit from the Central Experiment Station, Serdang, illustrated the propagation of fruit trees by three different methods, *i.e.* marcottage, etiolation, and bud-grafting.

Departmental publications in English were on sale, and publications in Malay, Chinese and Tamil were distributed.

School of Agriculture, Malaya.

The exhibits of the School of Agriculture were in three groups: (1) photographs and propaganda film, (2) a selection of some twenty different varieties of vegetables grown by students at the School and (3) poultry.

The poultry exhibit was one of the most outstanding features of the Exhibition, and attracted considerable interest, two European officers and three senior students being on duty the whole time and fully occupied in answering queries.

The exhibit was housed separately and attractively, covering an area of 1,000 square feet, and comprised two pens of pullets and an *attap* shed containing miscellaneous exhibits. One pen contained locally bred Rhode Island Reds, and the other, locally bred Light Sussex, each group being accommodated in a type of portable house evolved at the School, which can also be utilized as a day shelter.

The birds shewn were of the home standard of weight, and, apart from housing, the object of these two exhibits was to demonstrate the fact that approximate breed weight can be attained with locally bred pure breeds, provided that they are well fed from the moment that they are hatched. A further object of the exhibits was to demonstrate simple principles of sound management, particularly in relation to the prevention of disease.

In the *attap* shed were some excellent pure-bred cockerels raised at the School. There was also a locally-made brooder and rearing outfit, and a small laying battery which is being tested at the School.

The interest aroused by the exhibit as a whole can be gauged from the fact that several visitors subsequently went to the School of Agriculture after the Exhibition to pursue their enquiries, and the number of tentative orders for stock and hatchings of eggs exceeded the potential output of the School for the remainder of this year and whole of 1937.

The Rubber Research Institute of Malaya.

The Chemical Division of the Rubber Research Institute of Malaya staged various exhibits. In the centre of the building were two scale models (scale 1:6) of the "Subur" type of smoke house, which for some time has been the standard recommendation of the Institute. In addition, a new experimental apparatus for concentrating latex was exhibited, and worked at intervals throughout the whole period of the Exhibition. A further exhibit demonstrated the dangers of copper contamination of latex and rubber, and shewed how this could be avoided. Many enquiries were received regarding these exhibits, and members of the staff were constantly in attendance to answer questions.

The Soils Division exhibited samples of the chief Malayan soil types, and the fertility attributes of these were illustrated by means of profile cards. The distribution of the various soil types was seen from the geological map. Graphs were on view giving the results of manuring and cultivation experiments on rubber on different soil types. Many enquiries were received, chiefly in connexion with manuring and replanting.

As part of its Small-Holders' Advisory Service the Institute erected two typical small-holders' smoke houses, such as can be made for a few dollars and will pay for themselves in about a month through the increased price obtained for the sheet smoked in them. These two smoke houses were working continuously, with Asiatic Rubber Instructors in attendance to explain their advantages. In addition, specimens of mangles suitable for small-holders were exhibited.

Medical Department.

The Public Health Exhibit was divided into two sections: (1) the Child Welfare Section, and (2) the Public Health Section. In the former, attention was drawn to the benefits of ante-natal care, the proper conduct of a normal labour and the rules of health in infancy and early childhood. For the Public Health Section a demonstration in the actual breeding of mosquitoes was given, in addition to showing modern methods in anti-malarial work. By means of numerous models the principles of modern sanitation were set forth, and attention drawn to the dangers of not carrying these out.

Other Government Departments.

The Posts and Telegraphs Department again provided telephone and postal facilities, and also staged a variety of interesting exhibits which continually attracted a large crowd of sightseers.

The Federated Malay States Railways displayed a 2nd class sleeping coach, advertising the facilities now available for travelling in comfort.

The Co-operative Societies Department, in addition to organizing the Village Industries Section, gave free cinema shows of propaganda films of agricultural interest.

Trade Section.

There was a disappointing decrease in stall-holders in this section, but stalls were, as usual, attractively designed and decorated. The models stall in this section was constantly surrounded by a large crowd, and the organizer is to be congratulated on the success of his obviously enthusiastic efforts.

General.

A rest-room for women was again provided by the Y.M.C.A. and was much appreciated.

A cycling carnival, badminton tournament and Malay "bangsawan" formed the amusement side of the Exhibition, and drew large crowds.

The Boy Scouts Association rendered extremely valuable services, and the police are to be congratulated on their excellent traffic control, which was assisted very considerably by the parking arrangements of the Automobile Association of Malaya.

Acknowledgment.

Acknowledgment is made of the assistance given by officers of the Department of Agriculture and of the Rubber Research Institute of Malaya in the compilation of this report.

Abstract.

TWENTY-SIXTH REPORT ON NATIVE RUBBER CULTIVATION IN THE NETHERLANDS INDIES.

*First Quarter 1936 with additional data up to the end of May.**

Prices.

As already stated in the preceding report, an export duty of 1 guilder-cent per ½ kilogram was imposed on rubber from January 1st 1936. The quarter opened with a quotation for Java standard sheet in Batavia of 19 guilder-cents or slightly more per kilogram, thus maintaining the price level of 20 guilder-cents obtaining at the end of December 1935. Subsequently prices improved, and at the end of the month 21 or 21½ guilder-cents was reached. After fluctuating from 22½ to 22¾ guilder-cents, the price towards the end of May was 23½ guilder-cents. Prices during the entire 1st quarter and the subsequent two months were considerably higher than in the 1st quarter of 1935. The firmness was attributed to the improving statistical position of the product and to increasing consumption. The half-monthly averages of the daily quotations for Java standard sheet in Batavia during the period under review—from January 1st to May 31st—were consecutively:—19.8, 21, 21.8, 22.5, 22.6, 22.9, 23.3, 23.5, 22.8 and 22.9 guilder-cents per ½ kg.

The increases and decreases effected in the extraordinary export duty on native rubber have lately been closely following the price trend.

The ratio between the prices of medium blanket and standard sheet in Singapore was further retained with slight fluctuations till the end of April. On the whole, medium blanket was quoted at about 1½ per cent. lower than standard sheet. In the early part of May this ratio became even more favourable, while from May 7th to May 14th the difference entirely disappeared and on one or two days the quotation for medium blanket was even ½ per cent. higher, afterwards becoming approximately 1 per cent. in favour of the standard sheet quotation.

Production and Exports.

The following table shews the monthly production and exports of native-grown rubber for the first five months of 1936.

The export figures for January and February include 24 and 5 tons respectively which must be placed to the account of 1935, since they belong to the rubber put under customs control on December 31, 1935, and furthermore they illustrate that, as a result of the maintenance of the domestic price at the desired level, the production of native rubber has not shewn great fluctuations. Seasonal activities in connexion with the cultivation of foodstuffs influence production as long as there is not too wide a fluctuation in domestic prices following manipulations of the extraordinary export duty.

* Abstract from *The Netherlands Indies,* Vol. IV No. 12, June 16, 1936.

Table I.

Monthly Exports of Native Rubber.
(in Metric Tons, Dry Equivalent)

Month 1936	Exports	Movements of Stocks	Production
January	9,330	+ 2,096	11,426
February	16,397	− 3,511	12,886
March (provisional)	9,455	+ 2,183	11,638
April („)	12,556	− 1,114	11,442
May („)	10,797	+ 665	11,462

Table II.

Quarterly Exports of Native Grown Rubber.
(in Metric Tons, Dry Equivalent)

Quarter	Group Ia Blankets	Group Ib Sheets	Group IIa Scraps	Group IIb Slabs	Total	Percentage of total formed by Ia Ib.
1935						
1st quarter ...	8,299	7,924	953	18,863	36,039	45.2
2nd „ ...	13,851	15,508	1,009	20,646	51,014	57.7
3rd „ ...	10,230	9,514	19	8,097	27,860	70.9
4th „ ...	13,104	12,452	16	4,361	29,933	85.4
Total ...	45,484	45,398	1,997	51,967	143,846	62.7
1st quarter 1936						
Acheen ...	5	23	—	49	77	36.0
Sumatra's E. Coast ...	1,630	456	76	2,192	4,354	48.0
Tapanuli ...	343	885	—	—	1,228	100.0
Sumatra's W. Coast ...	369	9	—	10	388	97.0
Riouw ...	—	1,868	87	295	2,250	83.0
Banka ...	—	354	—	1	355	100.0
Djambi ...	1,386	3,582	—	148	5,116	97.0
Palembang ...	2,028	183	—	3,675	5,886	37,5
West Borneo ...	4,172	5,190	—	—	9,362	100.0
S. & E. Borneo ...	3,204	2,505	—	457	6,166	92.5
Total ...	13,137	15,055	163	6,827	35,182	80.0

Table III.

Quarterly Exports of Dry Native Grown Rubber to Consuming Territories.

(in Metric Tons, Dry Equivalent)

Quarter	Consuming Territories				Singapore and Penang	Total
	America	Europe	Japan	Total		
Blankets						
1935 1st quarter ...	4,208	886	411	5,505	2,794	8,299
2nd „ ...	7,986	851	185	9,022	4,823	13,845
3rd „ ...	6,270	744	146	7,160	3,006	10,166
4th „ ...	6,887	1,062	324	8,273	4,789	13,062
Total ...	25,351	3,543	1,066	29,960	15,412	45,372
1936 1st quarter ...	7,154	453	307	7,914	5,209	13,123
Sheets						
1935 1st quarter ...	432	168	455	1,055	6,917	7,972
2nd „ ...	1,217	278	473	1,968	13,539	15,507
3rd „ ...	1,533	513	167	2,213	7,326	9,539
4th „ ...	1,079	316	683	2,078	10,374	12,453
Total ...	4,261	1,275	1,778	7,314	38,156	45,470
1936 1st quarter ...	1,747	244	270	2,261	12,818	15,073

As already mentioned in the previous report the registration of native rubber plantations is being carried out with all possible energy.

The following data are being gathered for every plantation: (1) number of tappable trees tapped; (2) number of tappable trees not tapped; (3) number of non-tappable trees; (4) planting distances; (5) class (the tappable plantations are classified by the character and condition of the bark into four classes; in addition there is one separate class for neglected holdings); (6) type of soil.

Registration is proceeding satisfactorily and although a great deal of work is still required it may be anticipated that it will be possible to introduce individual restriction in all native rubber-growing districts from January 1st 1937.

Review.

The Termite, *Microtermes pallidus* Hav., in Relation to Tea in Malaya.

G. H. Corbett and N. C. E. Miller, Special Bulletin, Scientific Series No. 17, Department of Agriculture, Straits Settlements and Federated Malay States. Price 50 cents Straits Currency, post free.

Since the experimental cultivation of tea commenced at the Central Experiment Station, Serdang, in 1925, the crop has suffered no conspicuous damage, either from pests or diseases, with one notable exception, namely termites. During a period of four years, Messrs. G. H. Corbett and N. C. E. Miller have investigated the form of attack and possibilities of control of the termite, *Microtermes pallidus* Hav. and record, in the bulletin under review, the results and experience gained.

It is always an advantage when experimenting with new crops to select dissimilar conditions of land, since the manner in which the plants react in the divergent circumstances often affords a clue to successful treatment. In the case under notice it was found that tea bushes made relatively more vigorous growth on virgin land than on land previously cultivated. This experience is in general agreement with that obtained with numerous crops under local conditions. In addition, however, the bushes on the impoverished soil suffered considerable damage from attacks of termites, at all stages of growth. A series of experimental treatments in the affected areas was inaugurated by the Entomological Division of the Department of Agriculture. These are described in detail in the bulletin under reference. It was found that the use of chemical poisons and other substances had only a temporary deterrent effect, contrary to experience in Ceylon with other termite species. The only possible control measures that emerged during the investigations were the restoration of vigour in the tea bushes by means of manuring, and care in pruning and removal of all dead wood throughout the fields.

The most important conclusion arrived at is the establishment of the fact that, to-date, tea bushes planted at Serdang on virgin land have suffered no damage whatever from termite attack. Those who may plant tea in Malaya in the future would be well advised to follow the recommendations made, resulting from this timely investigation.

In addition to descriptions of certain stages in the development of *Microtermes pallidus* Hav. and *Termes javanicus* Holmg., a number of line drawings and half-tone plates illustrate the text. The two termites described were found in association but the former only is responsible for direct damage to the tea bushes.

J. N. M.

RETIREMENT OF LT.-COL. B. J. EATON, O.B.E., F.I.C., F.C.S., F.I.R.I.

Lt.-Colonel B. J. Eaton, O.B.E., Agricultural Chemist, retired from Government Service on the 1st November 1935. He joined the service as Government Chemist on 12th May, 1906, and was appointed Agricultural Chemist on 27th August 1910. He acted as a Director of Agriculture from 24th May 1921 to 8th February 1922, and as Secretary for Agriculture from 9th February to 24th April 1926. On 1st November 1926 he was seconded to the Rubber Research Institute of Malaya as Head of the Chemical Division, and became acting Director of that Institution on 27th July 1929, being confirmed in the appointment on 1st November 1930.

The rubber industry owes much to the conspicuous research work which he carried out over a number of years, the results of which have been published in a number of books and contributions to the literature on this product.

As Director of the Rubber Research Institute he has shown that he is equally successful as an administrator as he is as a scientist, and the Institute owes much to his initiative and ability. It must not be forgotten that while with the Department of Agriculture, Lt.-Colonel Eaton carried out valuable investigations on a number of crops other than rubber, a record of which he leaves in the publications of the Department.

His long association with Malaya and his wide knowledge have always been readily given to the Department of Agriculture, and in this connexion the writer wishes to acknowledge the very valuable assistance he has given as a member of the Publicity Committee in the editing of this Journal.

Lt.-Colonel Eaton leaves Malaya with the good wishes of the officers in this Department, and we trust that his services to scientific agriculture may not be discontinued on account of his retirement.

D. H. G.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports by Agricultural Officers.

August, 1936.

The Weather.

Although the rainfall records received from certain areas show distinct variation from the majority, the greater number of the returns indicate that the low rainfall which characterized last month continued through August over most of the Peninsula, although more humid atmospheric conditions prevailed generally.

In Kedah and North Province Wellesley, dry conditions obtained during the first week, but thereafter wetter weather prevailed with periodic heavy showers and the rainfall recorded approximated to average. In South Province Wellesley and through practically the whole of Perak, the dry weather continued and precipitation was below the average for the month except on the coast of Lower Perak, where precipitation approximated to normal. This sparcity of rainfall was also common to the north coastal area of Selangor, North Pahang and Temerloh District, the east coast of Pahang and South Johore.

Much wetter weather than normal prevailed over the inland areas of Negri Sembilan and along the northern portion of the west coast of Johore and some flooding occurred in consequence. Precipitation approximated to normal in Malacca, Singapore and Kelantan.

Remarks on Crops.

Padi.—Planting was almost completed in North Kedah and made good progress in South Kedah under favourable weather conditions. In Province Wellesley, the conditions were not so favourable. Planting proceeded satisfactorily in the north but lack of water retarded operations in parts of Central and South Districts. The continued dry weather in Krian has retarded operations in most areas except Bagan Serai, and, consequently, prospects are not propitious. In the north-west, practically no planting was done at the end of the month and the difficulty in rotting down the cut vegetation through scarcity of water has led to the heaping of the partially rotted material in the fields, a practice that is inducive to rat damage to the crop on account of the harbourage these heaps afford the rodents. Similar retardation of operations through water shortage is reported from most other areas in Perak except the Bukit Gantang area in Larut and the Sungei Manik area, where the irrigation systems have maintained adequate water supplies, notwithstanding the continued dry weather. In Stage I, Sungei Manik, almost all the cultivators have adopted the *rakit* type of nursery followed by two transplantings, and the plants are making good growth. There has been some delay in clearing the land for planting, except in the oldest established portion of the

area where this work is nearing completion. In Stage II, secondary burning has proceeded satisfactorily except in the portion occupied by Kuala Kangsar Malays, where the first burn was poorly done. It is doubtful whether much of this latter portion will be planted in the coming season. In the remaining area where burning was satisfactory, padi has been dibbled instead of being sown in nurseries as advised. It would seem that the cultivators expect the conditions to be more favourable for dry padi than for wet, in spite of assurances having been given that water supplies would be adequate when needed. A good deal of maize has been dibbled in with the padi and it is expected that much of this is sufficiently far advanced to produce a crop before it is spoilt by flooded conditions. In Selangor, planting has been completed in the irrigated areas with the exception of Kuang and Beranang. At Kuang, a brushwood dam made by the cultivators lasted only a short time owing to faulty construction. At Beranang, water from the recently completed irrigation channels is available, but the cultivators are divided in opinion as to whether to plant this season or wait until January. They have been advised that it is preferable to plant a short season padi immediately rather than wait until January, as the prospects of obtaining a satisfactory crop from a January sowing are problematical. Of the non-irrigated areas, Bukit Cheraka is the worst situated, with nurseries already two months old and the fields quite dry. Nurseries were sown at Tanjong Karang in the first week of August and at Panchang Bedena a little later, but here also the fields are quite dry, with no prospect of suitable planting conditions obtaining until rainfall is sufficient to flood the land and fill the drains. In Negri Sembilan, the appearance of the crop is reported to be generally satisfactory, except in Kuala Pilah District where cultural operations have been very irregular. In Malacca, planting is nearing completion under generally favourable conditions. There has been a marked increase in the use of rock phosphate as a manure this season. In Pahang, transplanting was completed in the down-river mukims of Lipis District and is in progress in the up-river mukims. In Raub District planting has commenced, but some nurseries were destroyed by drought, especially in the mukim of Semantan Ulu. In Temerloh District it is reported that an increased area is being planted as compared with last year and the growth of the crop is satisfactory in Bentong District. Reports from East Pahang record an increased area planted in Pahang Tua mukim and some water shortage in Kuala Kuantan. In Kelantan, much of the dry padi land still remains unplanted and cultivation for long term wet padi in Pasir Puteh District is backward.

Rubber.—Prices for smoked and unsmoked sheet covered by coupons remained substantially the same as last month in most centres but eased slightly in some.

The Province Wellesley Circle report records that much uncouponed rubber is being taken from south of the Province for sale in Penang. In South Province Wellesley respective prices for uncouponed rubber are as high as $14 per picul with coupons changing hands at $21 per picul equivalent. Coupons are, however, plentiful in Penang and change hands at a low figure; hence there is a strong demand for uncouponed rubber to cover the excess coupons.

During the month a further 10 smoke cabinets were constructed, 1 in Kedah, 5 in Perak (with 5 others under construction in Batang Padang District) and 4 in Johore.

Reports show that great differences existed in different parts of the country in the price offered for small-holders' smoked sheet as compared with unsmoked. Thus in South Province Wellesley, there was a difference of only 35 cents per picul between the lowest grade F.A.Q. and standard smoked sheet. Under these circumstances it is more economical for small-holders to sell unsmoked sheet. In Penang there is by comparison a greater difference between unsmoked and smoked sheet, through lower quotations being offered for the former. It is similarly reported from Negri Sembilan that the smoke cabinets erected in Kuala Pilah District were not in use owing to the small difference in price quotations between smoked and unsmoked sheet. On the other hand, an owner of a smoke cabinet at Pondok Tanjong in Perak is obtaining better prices than heretofore for his smoked sheet by from $1.20 to $1.50 per picul, marketing direct in Taiping. It is reported from Pahang North that prices for smoked sheet have risen slightly whilst quotations for unsmoked have decreased.

Coconuts.—Copra prices have shown distinct improvement during the month. The Penang quotation for sundried touched $5.90 per picul on several days towards the end of the month with an average for the month of about $5.65 per picul.

The demand for fresh nuts in Province Wellesley for export was so brisk that copra making by small-holders remained uneconomic. The price offered for fresh nuts was $25 per 1,000 in accessible places and correspondingly lower where transport is difficult. The buyers of fresh nuts have extended their field of activities very considerably during recent months. In the Bagan Datoh District of Perak a further twin-smoking cabinet is nearing completion. This makes the third for the area, all three being erected in out-of-the-way kampongs. The kiln at Beserah in Pahang, owned by a Malay small-holder, continued to function throughout the month and his produce was disposed of at satisfactory prices. In Johore, four further cabinet-type kilns were erected in the Batu Pahat District and two in the mukim of Sungei Balang, Muar District. Chinese copra dealers in this State are showing considerable interest in the cabinet type of kiln. A Chinese kongsi at Benut in Batu Pahat District, that claims to handle 300,000 nuts a month, has erected several cabinet kilns of a larger size than has hitherto been tried. Experiments with a large size cabinet kiln at Klang Coconut Station show that kilns so large as these require very special attention to the method of firing, and no fully satisfactory method has yet been found although further experiments are proceeding; the venture by the Chinese will, therefore, be watched with particular interest. The Agricultural Officer, Johore Central, visited the islands of Babi, Aur, Pemanggil and Tinggi, situated off the east coast of Johore, and erected a cabinet kiln on each with the object of effecting improvement in the methods of copra production which are at present somewhat primitive.

Agricultural Stations and Padi Test Plots.

Agricultural Stations.—Plots of one relong (.71 acre) were planted with pulasan and pineapples respectively at Gaja Mati Station in Kedah. In the Province Wellesley Circle, a plot of pepper was planted at Bukit Mertajam Station and, at Ayer Itam Station, sweet potatoes were planted and holing continued for arecanuts, whilst the planting of carpet grass on the main paths was in progress. At Selama Station in the Krian Circle of Perak, Stage III of the standard manurial experiment for annual dry crops was harvested, the crop being tapioca. At Tanah Rata, Cameron Highlands, further sowings were made of seed of *Aleurites montana,* collected on the Station, and seeds of *Cinchona succirubra* were sown in nursery beds. In Selangor, seeds of rambutan, durian and pulasan were sown in nursery beds at both Cheras and Telok Datoh Stations to provide material for budding. It has been decided to close down both the Chinese vegetable garden and the piggery at Cheras Station as it is considered both these ventures have served the purpose for which they were established. The future main functions of the Station will be fruit and poultry raising for distribution and demonstration. At Tangkak Station in Johore North, a plot of the Changi variety of tuba root was planted, the poultry runs marked off and a number of various seeds sown in the nurseries.

Padi Stations and Test Plots.—In Kedah, planting was completed or in progress on all Stations and Plots under satisfactory conditions except at Langkawi and Pulai Test Plots, where nurseries were sown early in the month. In Province Wellesley, planting was commenced at Bukit Merah Station under satisfactory conditions. The growth of seedlings in the nurseries was not very satisfactory. The clearing of the Sungei Acheh Test Plot was completed, but scarcity of water is retarding the rotting of the cut vegetation. In Krian, planting on Titi Serong Station is later than usual, having commenced only at the end of the month. Similar delay in operations owing to scarcity of water was experienced at most Test Plots in Krian except Bagan Serai and Sungei Kepar, where seedlings have made good growth and water has been sufficiently plentiful to allow operations to be performed to schedule time. At Talang Station the seedlings made good growth in the usual dry nurseries but planting was commenced under somewhat unfavourable conditions due to difficulties with the dam which has been a source of trouble in previous years. At Sungei Manik Station, seedlings have made good growth, except on a hard portion of the area which was the site of a former path, and irrigation conditions are good so that it is expected that planting should proceed satisfactorily, both on the half planted by daily paid labour and on the other portion planted by tenants. In Selangor, flowering has commenced on Kajang Test Plot and ploughing was completed at Kuang. Nurseries were sown at the Tanjong Karang and Panchang Bedena Test Plots. The seedlings have made satisfactory growth, but prospects for planting are not favourable unless copious rain soon falls, as the land is still dry and the water table low. In Negri Sembilan, seasonal operations were carried out on all Test Plots under satisfactory conditions and the planted padi has made good growth generally. It is recorded that at Kendong Test Plot marked increased growth is

shown on the areas treated last season with heavy dressings of rock phosphate and superphosphate, as compared with other areas not so treated. In Malacca the planting of all experiments was completed at Pulau Gadong except for the short term Radin Siak variety. On the mechanical cultivation area, notwithstanding the difficulties experienced through excess water during drilling operations, the growth of the plants is good except for low areas where germination was poor. Weed growth is, however, heavy in patches, but it is expected that irrigation, which is to commence shortly, will ameliorate the latter trouble. In Pahang, some scarcity of water was experienced at the Lipis and Dong Test Plots, but the growth of the plants is satisfactory. At Sungei Blat Test Plot seedlings have made good growth in the nurseries, but some water shortage is feared when planting is due to commence. In Kelantan, planting was begun at Pasir Puteh. At the Central Station, the planting of dry padi was completed and nurseries of wet padi were sown. At Bachok, the fourth harrowing and ploughing was completed on the 5th of the month and planting was done on the following day. Growth of the plants is only moderate. Planting of the wet padi was begun at Bachok.

DEPARTMENTAL NOTES.

Visits of the Adviser on Agriculture.

The Hon'ble the Acting Adviser on Agriculture, Malay States, visited Teluk Anson on the 28th and 29th August, and read a paper on the Competitors and Economic Prospects of the Coconut Industry to the Teluk Anson Branch of the Incorporated Society of Planters. He also took the opportunity of visiting the new Sungei Manik Padi Area.

The Acting Adviser inspected the Government Dairy Farm, Fraser's Hill on 15th August.

Tour of the Rural Lecture Caravan.

The Rural Lecture Caravan was on tour in Pahang from August 8th to August 27th. Twenty centres were visited, two days being spent in each locality. The tour commenced at Jerantut and ended at Benus (Bentong); it was conducted almost entirely by river, the projectors and exhibits being carried by house boat.

Leave.

Mr. R. B. Jagoe, Assistant Botanist, has been granted an extension of leave on half pay for one month from 18th September for the purpose of study of cytological technique and cytogenetical problems. Mr. Jagoe is working on these problems at the John Innes Horticultural Institute, Menton, Surrey.

Mr. J. A. Baker, Agricultural Officer, returned from leave on the 2nd September, and assumed temporary duty at Headquarters as assistant to the Chief Field Officer on the 3rd September.

Statistical.

MARKET PRICES.

August, 1936,

Major Crops,

Rubber.—The market remained steady throughout the month at the lower level recorded at the close of July, with slight further weakening. Spot loose opened in Singapore at $26\frac{7}{8}$ cents per lb. and closed at $26\frac{1}{2}$ cents per lb. The average price for the month of No. 1 X. Rubber Smoked Sheet was 26.59 cents per lb. as compared with $26.92 cents in July. The London average price was 7.58 pence per lb., and the New York price 16.17 cents gold, as compared with 7.70 pence, and 16.4 cents gold in the previous month.

Prices paid for small-holders' rubber at three centres during August are shewn in the following table.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, August, 1936.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.				Kuala Kangsar, Perak.				Batu Pahat, Johore.			
	6	13	20	27	5	12	19	26	5	12	19	26
Smoked sheet	34.00	33.70		33.60	34.25	34.00	33.50	33.53		33.50	33.40	
Unsmoked sheet	32.50		33.00	32.00		32.00	31.10		32.50	32.10	32.00	32.20
Scrap			27.00									

Transport by F. M. S. R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent

Palm Oil.—The market continued its upward trend and the month's prices are given in Table II.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1936.	Palm Oil in Bulk, c i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
August 7	19. 7. 6	10. 12. 6
„ 14	20. 0. 0	10. 12. 6
„ 21	20. 0. 0	10. 17. 6
„ 28	20. 10. 0	10. 15. 0

Copra.—Prices again continued on the upward grade with slight occasional weakening. The sun-dried grade opened in Singapore at $5.15 per picul and closed at $5.55, averaging $5.40 per picul for the month as compared with $5.25 in July. The mixed quality averaged $4.85 as against $4.82 per picul in the previous month.

Copra cake improved to $2 per picul, averaging $1.95 for the month, as compared with $1.62 in July.

Rice.—The average wholesale prices of rice per picul in Singapore in July were as follows:—Siam No. 2 (ordinary) $3.62, Rangoon No. 1 $3.45, Saigon No. 1 $3.50, as compared with $3.75, $3.50 and $3.50 respectively in June. The corresponding prices in July 1935 were: $4.22, $3.85 and $3.87.

The average retail market prices in cents per gantang of No. 2 Siam rice in July were: Singapore 28, Penang 30, Malacca 26, or unchanged as compared with June.

The average declared trade value of imports of rice in July was $3.57 per picul, as compared with $3.64 in June and $3.60 in May.

Padi.—The nominal price of padi at the Government Rice Mill, Bagan Serai, was $1.90 per picul. Retail prices of padi ranged from 6 to 13 cents per gantang.

Pineapples.—Prices per case remained unchanged throughout the month at: Cubes $3.40, Sliced Flat $3.10, Sliced Tall $3.40.

Prices of fresh fruit per 100 were: Johore 1st quality $2.70 to 4.50, 2nd quality $1 to $3.80, 3rd quality 80 cents to $2; Singapore $3 to $3.70; Selangor $1.20 to $1.80.

Beverages.

Tea.—Nine consignments of Malayan tea were sold on the London market during August; three consignments were of upland tea and were sold at 1s. 0d. and 1s. 0¼d. per lb., and the lowland tea ranged from 11½d. to 1s. 0d. per lb.

Average London prices per lb. during August for consignments of tea from other countries were as follows:—Ceylon 1s. 1.03d., Java 10.48d., Indian Northern 1s. 1.69d., Indian Southern 11.92d., Sumatra 9.85d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report*, 25th August, 1936, of the Colombo Brokers' Association, and are as follows, in rupee cents per lb:— High Grown Teas 78 cents, Medium Grown Teas 66 cents, Low Grown Teas 61 cents.

Coffee.—Sourabaya coffee weakened slightly in Singapore during August, averaging $12.94 to $13.94 per picul as against $13.16 to $14.35 per picul in July. Palembang coffee averaged $6.88 to $7.81 per picul as compared with $6.80 to $7.70 in July.

Spices.

Arecanuts.—The following are the averages of the range of prices per picul in Singapore during August: Splits $4.81 to $6.38; Red Whole $4.31 to $5.88; Sliced $8.75 to $10.38.

The Singapore Chamber of Commerce prices improved still further, average prices per picul being: Best $7, Medium $6.40, Mixed $5.75.

Pepper.—Nominal quotations in Singapore were again lower, averages for the month being: Singapore Black $7.40, Singapore White $13.70, Muntok White $14.05 per picul.

Nutmegs.—Prices in Singapore improved during August, averages being: 110's $29.40, 80's $29.60 per picul, as compared with $28 and $29 respectively in July.

Mace.—Siouw rose to $95, and Amboina to $80 per picul, average prices for the month being $90 and $75 per picul respectively, as compared with $85 and $70 in July.

Cloves.—Nominal quotations for both Zanzibar and Amboina remained unchanged at $37 per picul.

Cardamoms.—Green cardamoms were quoted during August in the Ceylon Chamber of Commerce reports from Rs. 1.65 to Rs. 1.82 per lb.

Miscellaneous.

Derris (Tuba Root).—The Singapore market remained dull throughout August in the marked absence of demand. Average prices were unchanged as compared with the previous month, being $48 per picul for roots sold on rotenone content, and $33 per picul for roots sold on the basis of ether extract.

Gambier.—The Singapore market improved slightly at the close of the month, average prices per picul being: Block $4.80, No. 1 Cube $9.80, as compared with $4.77 and $9.88 respectively in July.

Tapioca.—Prices in Singapore continued unchanged at: Flake, Fair $5.50, Seed Pearl $5.50, Medium Pearl $6.50 per picul.

Sago.—There was a further marked improvement in the Singapore market during August, average prices per picul being: Pearl, Small Fair $4.18, Flour, Sarawak Fair $2.69, as compared with $3.92 and $2.44 respectively in July.

Tobacco.—Prices of prepared leaf in Selangor ranged from $75 to $100 per picul, and in Kelantan were $100, $81 and $64 per picul for 1st, 2nd and 3rd qualities respectively.

The range of prices elsewhere was: 1st quality $20 to $40, 2nd quality $15 to $32, 3rd quality $10 to $21 per picul.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Kohyei & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross. London, S.W.1.

GENERAL RICE SUMMARY*

July, 1936.

Malaya.—Imports of foreign rice during July were 62,886 tons, and exports 17,169 tons. Net imports for the seven months were 306,089 tons as compared with 263,697 tons in 1935.†

Of the imports during July, 45 per cent. were consigned to Singapore, 20 per cent. to Penang, 5 per cent. to Malacca, 23 per cent. to the Federated Malay States, and 7 per cent. to the Unfederated Malay States. The imports by countries of origin were as follows:—Siam 66.5 per cent., Burma 30.7 per cent., French Indo-China 1.6 per cent., and other countries 1.2 per cent.

Of the July exports, 73 per cent. were consigned to the Netherlands Indies and 27 per cent. to other countries. The various kinds of rice exported were as follows (in tons, percentages in brackets): Siam 13,127 (76.5), Burma 3,184 (18.6), French Indo-China 712 (4.1), parboiled 143 (0.8), local production 3 (0.0).

India and Burma.—Foreign exports of rice for the first half of 1936 totalled 766,000 tons as compared with 1,134,000 tons in 1935, a decrease of 32.5 per cent. Of these exports 4.2 per cent. were to the United Kingdom, 20 per cent. to the Continent of Europe, 26.9 per cent. to Ceylon, 19 per cent. to the Straits Settlements and the Far East, and 29.9 per cent. to other countries. The corresponding percentages in 1935 were 4.8, 12.1, 19.9, 32.5 and 30.7.

Siam.—Exports of rice and rice products from Bangkok during May were 143,885 tons; the cumulative total for the five months was 692,017 tons as compared with 701,494 tons in 1935.

Japan.—The latest information available was published in the June Summary.

French Indo-China.—Entries of padi into Cholon during the first seven months of 1935 totalled 1,026,975 metric tons as compared with 1,223,082 metric tons in 1935, a decrease of 16 per cent. Exports of rice during the same period decreased by 14.6 per cent. from 1,270,418 metric tons in 1935 to 1,085,387 metric tons in 1936.

The Netherlands Indies.—According to the *Netherlands Indies Economic Bulletin*, 1st June, 1936, the 1935 padi crop was on an average considerably better than in 1934. The total yield of "wet padi" in Java was estimated at 7 million tons in comparison with 6.4 million tons in 1934.

Ceylon.—Imports during the first seven months of 1936 totalled 312,628 tons, as compared with 299,485 tons in 1935, an increase of 4.4 per cent. Of these imports 13 per cent. were from British India, 62.2 per cent. from Burma, 0.2 per cent. from the Straits Settlements and 24.6 per cent. from other countries.

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* Abridged from the Rice Summary for July, 1936, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935.

Europe and America.—Shipments to Europe from the East during the period 1st January to 9th July were 753,857 tons, as compared with 473,416 tons in 1935, an increase of 59.2 per cent. Of the 1936 shipments 32.6 per cent. were from Burma, nil from Japan, 59 per cent. from Saigon, 7.2 per cent. from Siam, and 1.2 per cent. from Bengal. The 1935 percentages were 63.5, 5.0, 24.7, 4.6 and 2.2.

Shipments for the Levant from the 1st January to 9th July, 1936, totalled 8,252 tons as compared with 22,224 tons in 1935, a decrease of 62.9 per cent. Shipments for Cuba, West Indies and America from 1st January to 2nd July aggregated 151,752 tons, as compared with 128,263 tons in 1936, an increase of 18.3 per cent.

MALAYAN AGRICULTURAL EXPORTS, JUNE AND JULY, 1936.

PRODUCT.	Net Exports in Tons						
	Year 1935	Jan.-July 1935	Jan.-July 1936	June 1935	June 1936	July 1935	July 1936
Arecanuts ...	21,885	14,644	17,334	2,257	2,726	2,277	2,380
Coconuts, fresh †	106,272†	62,152†	70,135†	9,537†	11,952†	13,522†	13,569†
Coconut oil ...	35,911	17,980	26,530	2,304	4,186	3,172	3,797
Copra ...	111,752	61,552	32,327	8,669	5,243	10,069	536
Gambier, all kinds	2,837	1,605	1,288	167	198	299	193
Oil cakes ...	11,361	4,423	9,209	347	1,824	830	2,059
Palm kernels ...	3,892	1,882	2,365	221	325	280	378
Palm oil ...	24,996	12,076	13,416	913	2,861	2,486	1,891
Pineapples canned	73,923	46,039	54,894	9,805	14,037	6,950	8,689
Rubber ¶ ...	378,381¶	230,917¶	185,952	28,307¶	29,457¶	37,972¶	33,119¶
Sago,—flour ...	10,920	5,319	3,485	577	635*	36*	1,038
,, —pearl ...	4,655	2,662	1,874	459	266	366	240
,, —raw ...	7,735*	4,176*	4,127*	849*	341*	561*	196*
Tapioca,—flake ...	1,953	1,136	1,002	133	74	155	108
,, —flour ...	755*	614*	1,169*	37*	149*	116*	187*
,, —pearl ...	17,169	9,785	9,330	1,366	1,844	1,866	1,402
Tuba root ...	567	361	405	56	50	48	47

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION (IN TONS) OF PALM OIL AND KERNELS

(As declared by Estates)

Month 1936	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S
January ...	1,395.4	326.5	258.6	37.2
February ...	1,531.9	372.4	244.2	54.6
March ...	1,878.4	534.5	302.9	88.0
April ...	1,410.6	446.8	250.0	80.0
May ...	1,346.1	644.8	238.1	114.6
June ...	1,557.4	658.3	245.5	100.9
July ...	2,270.5	975.7	349.1	147.6
Total ...	11,390.3	3,959.0	1,888.4	622.9
Total January to July, 1935 ...	8,441.5	3,137.3	1,274.3	454.7
Total for year 1935 ...	17,338.7	5,764.6	2,711.1	818.4

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 31ST JULY, 1936.

State or Territory	Acreage of Tappable Rubber end 1935	Estates which have entirely ceased tapping: Acreage	Estates which have entirely ceased tapping: Percentage of (3) to (2)	Estates which have partly ceased tapping (a): Acreage	Estates which have partly ceased tapping (a): Percentage of (5) to (2)	Area of Tappable Rubber never been tapped: Acreage	Area of Tappable Rubber never been tapped: Percentage of (7) to (2)	Total (3) + (5)	Percentage of (9) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS:—									
Province Wellesley	44,526	400	0.9	16,449	36.9	503	1.1	16,849	37.8
Malacca	121,601	4,260	3.5	31,019	25.5	2,834	2.3	35,279	29.0
Penang Island	2,575	675	26.2	569	22.1	283	11.0	1,244	48.3
Singapore Island	34,525	3,607	10.4	9,725	28.2	394	1.1	13,332	38.6
Total S.S. ...	203,227	8,942	4.4	57,762	28.4	4,014	2.0	66,704	32.8
FEDERATED MALAY STATES:—									
Perak	294,988	12,139	4.1	70,145	23.8	14,527	4.9	82,284	27.9
Selangor	332,165	12,481	3.8	68,591	20.6	15,849	4.8	81,072	24.4
Negri Sembilan	258,304	13,077	5.1	52,992	20.5	16,601	6.4	66,069	25.6
Pahang	77,210	9,711	12.6	26,643	34.5	16,952	22.0	36,354	47.1
Total F.M.S. ...	962,667	47,408	4.9	218,371	22.7	63,929	6.6	265,779	27.6
UNFEDERATED MALAY STATES:—									
Johore	432,443	31,141	7.2	67,811	15.7	39,310	9.1	98,952	22.9
Kedah	199,607	16,426	8.2	25,505	12.8	15,382	7.7	41,931	21.0
Kelantan	30,474	403	1.3	10,365	34.0	5,093	16.7	10,768	35.3
Trengganu (b)	4,643	Nil	Nil	Nil	Nil	138	3.0	Nil	Nil
Perlis (c)	1,575	Nil	Nil	689	43.7	64	4.1	689	43.7
Brunei	6,010	Nil	Nil	1,712	28.5	913	15.2	1,712	28.5
Total U.M.S. ...	674,752	47,970	7.1	106,082	15.7	60,900	9.0	154,052	22.8
TOTAL MALAYA ...	1,840,646	104,320	5.6	382,215	20.8	128,843	7.0	486,535	26.4

Notes:—(*a*) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.

(*b*) Registered Companies only.

(*c*) Rendered quarterly.

MALAYAN RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JULY, 1936, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January to July 1936		during the month		January to July 1936						
	Ports	Dealers	Estates of 100 acres and over	during the month	January to July 1936	during the month	January to July 1936	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to July 1936
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES:—																				
Federated Malay States ...	...	5,708	11,936	10,894	68,739	8,596	36,500	Nil	Nil	Nil	Nil	13,772	4,359	79,033	25,680	...	7,701	11,289	13	60
Johore ...	..	2,238	4,264	4,385	28,169	3,591	20,800	Nil	111	Nil	525	2,274	5,486	15,338	33,181	...	2,594	4,235	...	...
Kedah ...	...	238	2,858	2,620	17,541	1,170	4,985	Nil	Nil	Nil	Nil	1,547	2,344	9,686	13,410	...	377	2,618	...	...
Perlis ...	...	4	20	10	74	30	140	Nil	Nil	Nil	Nil	Nil	33	Nil	207	...	13	18	...	...
Kelantan ...	...	240	273	320	1,958	1,071	4,055	Nil	Nil	Nil	Nil	142	1,126	959	4,969	...	307	329	...	...
Trengganu ...	...	55	50	195	1,515	97	758	Nil	Nil	Nil	Nil	Nil	292	Nil	2,273	...	55	50	...	...
Brunei ...	...	3	49	47	294	93	424	...	...	...	...	...	138	...	717	...	19	35	...	...
Total Malay States	...	8,486	19,450	18,471	118,290	14,648	67,662	Nil	111	Nil	525	17,735	13,778	105,016	80,437	...	11,066	18,574	13	60
S. SETTLEMENTS:—																				
Malacca ...	...	2,850	1,206	1,029	6,923	445	3,792	Nil		Nil		3,738		16,734		...	1,920	1,188	...	...
Province Wellesley	...	1,423	566	444	2,779	187	1,460	Nil		Nil		9,259		50,600		...	952	509	...	...
Penang ...	2,041	5,188	10	14	114	27	564	3,084	12,981	18,153	78,166		Nil		Nil	1,330	5,021	9	...	...
Singapore ...	2,795	18,236	160	139	1,010	43	804	15,906		86,127		22,382		127,721		5,603	17,489	161	29	163
Labuan ...	...	15	Nil	Nil	Nil	14	112	48		478		Nil		Nil		...	16	Nil	...	...
Total Straits Settlements ...	4,836	27,712	1,942	1,626	10,826	716	6,732	19,038	12,981	104,758	78,166	35,379	Nil	195,055	Nil	6,933	25,398	1,867	29	163
Total Malaya ...	4,836	36,198	21,392	20,097	129,116	15,364	74,394	19,038	13,092	104,758	78,691	53,114	13,778	300,071	89,437	6,933	36,464	20,441	42	223

*Amended

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	6,438	16,525	4,710	2,481	2,282	184
WET RUBBER	1,263	964	311	426	312	193
TOTAL ...	7,701	17,489	5,021	2,907	2,594	377

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to July 1936
29	30	31
Singapore ...	33,039	190,142
Penang ...	13,000	37,088
Port Swettenham.	5,766	34,142
Malacca ...	1,309	2,699
MALAYA ...	53,114	300,071

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to July 1936
32	33	34
Malay States ...	31,513	185,453
Straits Settlements	2,529	16,642
MALAYA ...	34,042	202,095

Notes:—
1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 22nd August, 1936.

METEOROLOGICAL SUMMARY, MALAYA, JULY, 1936.

Locality.	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B.	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total.	Total.	Most in a day. Amt.	Number of days: Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total.	Daily Mean.	Per cent.
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	90.8	71.7	81.3	98	68	83	75	84.0	84.8	1.41	35.8	0.67	6	6			1	196.45	6.34	51
Bukit Jeram, Selangor ...	88.3	72.7	80.5	91	67	80	75	83.8	86.3	2.25	57.2	0.55	9	8	1		3	231.70	7.47	61
Sitiawan, Perak ...	89.2	72.6	80.9	92	69	85	76	84.1	84.7	6.13	155.7	1.02	16	13	3			213.75	6.89	56
Temerloh, Pahang ...	88.8	72.0	80.4	93	70	81	74	85.2	85.8	0.88	22.3	0.37	7	4	1	9		186.70	6.02	49
Kuala Lipis, Pahang ...	89.3	71.7	80.5	93	67	81	75	84.4	84.9	1.25	31.8	0.42	9	6	2	17	2	186.20	6.01	49
Kuala Pahang, Pahang ...	86.8	74.2	80.5	91	69	81	78	85.5	86.2	5.06	128.5	1.70	9	6	1			209.10	6.75	55
Kallang Aerodrome, S'pore ...	86.1	77.7	81.9	89	71	82	82	82.5	83.8	4.88	124.0	1.56	12	9	3		1	210.90	6.80	56
Butterworth, Province Wellesley ...	87.9	73.9	80.9	91	69	81	76	84.8	86.0	6.27	159.3	1.66	10	8	1		2	212.05	6.84	56
Bayan Lepas Aerodrome Penang ...	87.2	73.8	80.5	90	70	80	77	84.2	84.7	9.81	249.2	3.93	13	12	2		2	200.80	6.48	53
Bukit China, Malacca ...	85.1	73.7	79.4	87	70	81	78	83.0	84.1	10.34	262.6	2.30	20	17	3		5	200.05	6.45	53
Kluang, Johore ...	87.6	70.9	79.3	93	67	76	75	81.8	82.5	4.32	109.7	0.91	15	14	3	10	1	197.70	6.38	52
Bukit Lalang, Mersing, Johore	86.8	71.9	79.3	91	69	77	74	81.9	82.0	9.44	239.8	2.80	17	14	6	2	3	217.05	7.00	57
Alor Star, Kedah ...	87.7	74.3	81.0	91	71	80	77	85.9	86.2	12.50	317.5	2.59	22	20	3			191.65	6.18	50
Kota Bahru, Kelantan ...	89.9	73.5	81.7	93	70	85	76	83.7	84.6	8.94	227.1	4.26	13	10	4		2	194.35	6.27	51
Kuala Trengganu, Trengganu	87.9	72.9	80.4	90	69	85	76	83.3	84.4	2.91	73.9	1.04	12	9	4	1	1	212.90	6.87	55
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	75.2	62.6	68.9	79	59	68	65	71.8	72.5	0.68	17.3	0.23	10	8		6	1	201.95	6.51	53
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.8	55.8	64.3	76	49	66	63	69.8	69.9	2.88	73.2	0.72	13	10		2	2	168.60	5.44	44
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.8	59.3	65.5	76	56	67	61			2.64	67.1	0.52	14	10		2	2	182.00	5.87	47

Compiled from Returns supplied by the Meteorological Branch, Malaya

The publications of the Department of Agriculture, S.S. and F.M.S. are issued in two series :—

(*a*) The Malayan Agricultural Journal, monthly at 50 cents per copy, or post free \$5/- per annum.

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The Adviser on Agriculture invites those interested to visit the Central Experiment Station and the School of Agriculture, Serdang, and also the other Experiment Stations, Agricultural Stations, Farm Schools, Padi Experiment Stations, and Padi Test Stations of the Department in various parts of the Straits Settlements and Federated Malay States.

Agricultural Stations and Padi Test Stations also exist in certain of the Unfederated Malay States, to which visits are welcomed by the State authorities.

Intending visitors to the Central Experiment Station should communicate with the Senior Assistant Agriculturist in charge, and to the School of Agriculture with the Principal.

The Central Experiment Station and the School of Agriculture are situated about fourteen miles by road from Kuala Lumpur and three miles from Serdang Railway Station where cars can be hired. Visitors' days at the Experiment Station are the first and third Wednesdays in each month.

Other Stations are listed below together with the addresses of officers to whom enquiries should be sent.

Experiment Station, Tanah Rata, *Agricultural Officer, Cameron Highlands.*

Coconut Experiment Station, Port Swettenham, *The Agriculturist, Department of Agriculture, Kuala Lumpur.*

Pineapple Experiment Station, Lim Chu Kang, Singapore, *Agricultural Officer, Singapore.*

Titi Serong Padi Experiment Station, *Agricultural Officer, Krian.*

Talang Padi Experiment Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*

Pulau Gadong Padi Experiment Station, *Agricultural Officer, Malacca.*

Dairy Farm, Fraser's Hill, *Manager.*

Bukit Mertajam Agricultural Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Selama Agricultural Station, *Agricultural Officer, Krian.*

Kuala Kangsar Agricultural Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*

Cheras Agricultural Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*

Rembau Agricultural Station, *State Agricultural Officer, Negri Sembilan, Seremban.*

Kuala Pilah Agricultural Station, *State Agricultural Officer, Negri Sembilan, Seremban.*

Sungei Udang Agricultural Station, Farm School, and Padi Test Station, *Agricultural Officer, Malacca.*

Kuala Lipis Agricultural Station, *State Agricultural Officer, Pahang, Kuala Lipis.*

Temerloh Agricultural Station, *Malay Agricultural Officer, Pahang South, Temerloh.*

Kuantan Agricultural Station, *Malay Agricultural Officer, Pahang East, Pekan.*

Pekan Agricultural Station and Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*

Ayer Itam Agricultural Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Raub Agricultural Station, *State Agricultural Officer, Pahang, Raub.*

Telok Datoh Agricultural Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*

Labuan Agricultural Station and Padi Test Station, *Agricultural Officer, Singapore.*

Kuala Kurau Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Bagan Serai Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Briah Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Selinsing Padi Test Station, *Agricultural Officer, Parit Buntar.*
Bukit Gantang Padi Test Station, *State Agricultural Officer, Perak, Taiping.*
Lenggong Padi Test Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*
Bruas Padi Test Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*
Sungei Manik Padi Test Station, *Agricultural Officer, Perak South, Teluk Anson.*
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Sungei Haji Durani Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Tanjong Karang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kuang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kajang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kuala Klawang Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
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Bawang Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
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Glugor Padi Test Station, *Agricultural Officer, Province Wellesley & Penang. Butterworth.*
Bukit Merah Padi Test Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Unfederated Malay States.

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Tangkah Agricultural Station, *Agricultural Officer, Johore North, Muar.*
Gaja Mati Agricultural Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Central Experiment Station, Kota Bharu, Kelantan, *State Agricultural Officer, Kelantan, Kota Bharu.*
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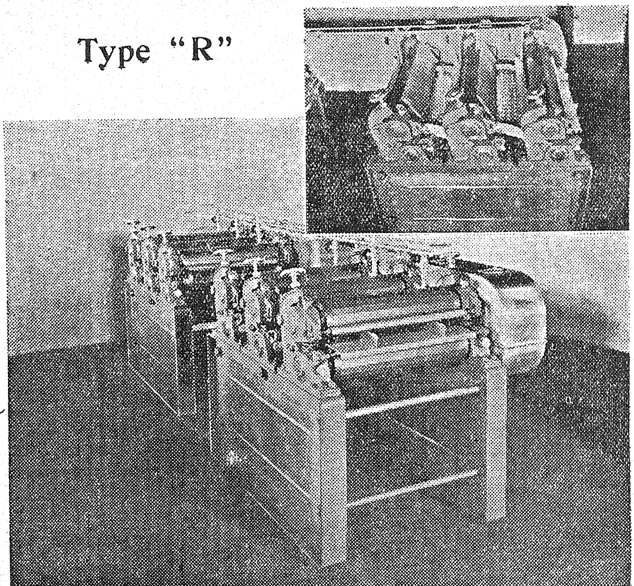

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THE

Malayan Agricultural Journal.

OCTOBER, 1936.

EDITORIAL.

The Malabar Coconut Industry.

Particular interest attaches to the account, given on another page, of the coconut industry on the Malabar coast of India, by reason of the pre-eminent position on the European copra market which was at one time held by the produce from this area. This enviable position was held until the increasing demands of India absorbed the entire production of Malabar.

We would refer the reader to previous articles which have, in recent years, been published by this Department dealing with the coconut industry in Malaya, the Philippines, Ceylon and the Solomon Islands. Comparison shews that the conditions under which coconuts are grown, and the methods of drying the kernel, vary very considerably, but by knowledge of methods and of the conditions obtaining in his own area, the coconut planter is enabled to introduce innovations having as their objects, greater crop production, improved quality of copra and greater economy of production.

In his article on the Malabar coconut industry, the author has given considerable attention to the coir industry.

It is probable that almost every coconut planter in this country has considered, at one time or another, the possibility of utilizing for greater profit the enormous quantities of coconut husks, but, as a rule, he has reluctantly decided that coir production is uneconomic under Malayan conditions. The subject is, however, still a live one, and we have recently seen coir fibre of excellent quality produced on a small plantation in this country and sold locally. The fortunes of this venture will be followed with interest, and it is to be hoped that, although as yet on a small scale, it may result in the establishment of a new Malayan industry.

It is a fact, however, that the bulk of the world's supply of coir is produced as a cottage industry, and under such conditions cost of production is very low. There seems little chance of any large development of coir production as a cottage industry in Malaya, owing to the numerous other and less arduous sources of income open to the small-holder. The local estate-produced coir, therefore, has to compete only with the imported product, and thus has an advantage of lower

freight charges. It is possible that if the quality can be maintained, and the price is attractive, a market may be established in Malaya to replace the net imports which annually exceed 1,000 tons and are valued at over $200,000.

Palm Oil.

The attention of readers is drawn to an article by Dr. T. A. Buckley on the "Dietetic Value of Palm Oil". In this article the author emphasises the value of palm oil as compared with that of other vegetable oils, in that it contains carotene, a source of Vitamin A, an important factor in the prevention of disease and promotion of growth.

The only other common oils containing this vitamin are fish oils such as cod liver oil, for which palm oil may be regarded as an efficient substitute, though of inferior quality to halibut liver oil.

Although palm oil, or more accurately, red palm oil is employed for cooking purposes in countries in which the oil palm is indigenous, it is perhaps curious that the local population has not adopted it as a substitute for, or a supplement to the cooking oils they are in the habit of using.

An explanation for this is, that most probably the taste for palm oil has to be acquired. This is unfortunate, since it has been demonstrated that for edible purposes, palm oil has a definite value, particularly as its vitamin activity is not destroyed by heat during cooking processes. We desire particularly to point out that an article on the subject of carotene in palm oil has recently been published by Dr. I. A. Simpson of the Institute of Medical Research, and that the article we reproduce in the present issue of this Journal is, to some extent, a pre-review of Dr. Simpson's paper which has been published earlier than we anticipated.

Preparation of Derris Roots for Export.

Much work has been carried out on investigating the insecticidal properties of several species of tropical plants such as *Derris, Lonchocarpus, Cracca* and *Mundulea,* to name only a few. Much, however, still remains to be done before the relative values as insecticides of the different genera, species, and even varieties of these plants can be fully determined on the basis of the actual toxic chemical substances, and of the relative qualities of these substances present in each of them.

Apart from obtaining data regarding the insecticidal efficiencies of such plants, it is highly desirable that growers should be in a position to state the amount and the proportions of toxic substances any particular type of plant grown under certain conditions is likely to yield.

A fairly reliable indication of the toxicity may be secured by testing solutions on various kinds of insects. Seeing, however, that many factors affecting insects used as test subjects must be taken into consideration, and that these factors affect the results of such tests, it is only by prolonged investigation that results are produced on which reliance can be placed with a fair degree of confidence.

The valuation of roots of plants yielding toxins must of necessity be made by chemical means which must conform to accepted standards, if they are to ensure comparable results when employed by other investigators.

This subject has been discussed elsewhere in a publication issued by this Department (Valuation of Tuba Root by C. D. V. Georgi and Gunn Lay Teik, Scientific Series No. 12, 1933). In amplification of this aspect of the subject under discussion, we now print an article in which the same authors describe further experiments designed the show the way to standardization of analytical methods, which, if applied to the analysis of *Derris* root, will enable growers to indicate the toxic composition and minimum toxic content of the root they are desiring to sell.

Original Articles.

THE COCONUT INDUSTRY ON THE MALABAR COAST OF INDIA

BY

F. R. MASON,

State Agricultural Officer.

The following observations refer only to areas in the coastal districts of Malabar and South Kanara, which, in 1931-32, had a total of 360,932 acres under coconuts, representing nearly two-thirds of the total area under this crop in the Madras Presidency.

Coconuts on the Malabar coast are essentially a small-holder's crop, the average size of a coconut holding or garden being under two acres. Except for one privately-owned estate of 100 acres, there are no organized large-scale plantations. The gardens are so small that the owner and his family can easily attend to the cultivation and harvesting, but some of the owners do not like doing manual work in the field and so employ hired labourers. The majority of the cultivators in the two coconut districts are Malayalees, and Malayalam is the language spoken.

Soil.

The soil on which coconuts are found growing in the coastal districts varies from almost pure white sand in a narrow band along the coast, through a red sandy loam, to gravelly soils on the hill slopes originating from laterite rock. In none of the localities visited were heavy soils encountered. Drainage is good and is practically all natural. Extensive bunding is carried out on inland areas to prevent soil erosion during the rainy season and also to encourage soil water movement on which the palms rely for their nutriment from the hills to the coast.

Climate.

The climate on the Malabar coast differs from that in Malaya in that there are definite wet and dry seasons. The average annual rainfall is about 130 inches, of which over three-quarters falls during the South West Monsoon from May to the end of September. This is followed by the North West Monsoon in October and November when from 10 to 15 inches of rain may fall. The remaining five months are practically rainless, small showers being uncertain and inadequate. Growth and nut development are therefore much more seasonal than in Malaya where rainfall is evenly distributed.

Condition of Holdings.

Planting is usually very irregular and palms of all ages are to be found in one garden. The normal practice is to carry on a programme of under-planting

and to remove old palms as they become unproductive. Despite this, the gardens are well kept but crops are comparatively poor and nut size is small. This is partly due to the fact that, with copra and oil at present prices, the cost of manuring, which is recognized as essential for satisfactory crops on these light soils, is beyond the means of the average peasant. The only form of manuring possible under present conditions is the use of wood ashes and small applications of cow-dung and/or green leaf, when obtainable, which are applied in trenches 3 feet wide about 6 feet from the base of the stem just before the monsoon sets in.

Cultivation.

Cultivation by ploughing is general and is usually carried out at least twice annually. The first ploughing takes place as soon as the rainy season is over and the land is left fallow: no weed growth takes place during the fallow season owing to drought conditions which last until the advent of the next monsoon. The gardens are again ploughed once or twice as soon as the rainy season commences. Surface cultivation is an important factor where rainfall is seasonal as it materially assists conservation of soil moisture during the dry season.

Planting.

Deep planting is the general practice throughout the coastal area. Three feet cubical pits are dug and a third of the depth filled with top soil, manure and ashes, if available. Seedling nuts, about one year old, are then planted about 2 to $2\frac{1}{2}$ feet below the surface. As the seedling grows so the hole is filled in until ground level is reached. This method is claimed to give a sturdier palm and to encourage deep rooting, a necessary factor during months of drought when the water table is very low. As a result, root development is encouraged from as large a surface of the stem or bole as possible. It is admitted that deep planting delays maturity and palms do not come into bearing as early as those planted on the surface, but the longer life of deep planted palms is claimed to overrule this objection. No development of roots above the surface of the ground was seen and, even on the lightest soils, there was little or no tendency of palms to lean.

Coconuts on Hill Slopes.

Coconuts are also grown extensively on the foot hills 20 to 25 miles from the coast. The soil here is a red sandy loam overlying a bed of laterite rock at varying depths. The land is terraced and bunded into plots of varying size according to the contour. Here again deep planting is the general rule and manuring is essential to obtain satisfactory crops. The secret of successful cultivation on these hill slopes seems to be the conservation of rainfall in the plots or terraces so that it can penetrate from terrace to terrace without causing soil erosion, and surface cultivation during the dry months. Yields on this type of land are not very high unless extensive manuring is practised. At present prices manuring is not profitable.

Harvesting.

Harvesting of nuts is carried out at intervals ranging from 1 to 2 months. Dry-season harvests are usually heavy but the crop is poorer during the rainy season. Climbing the palms is the normal method of harvesting and the nuts are removed by hand. There is a noticeable tendency for immature nuts to be harvested, since husks from slightly under-ripe nuts make a better-coloured fibre than those from fully-ripe nuts and this is an important factor in a district where practically every husk is turned into fibre, although it has an effect on the quality of the copra produced.

As reported above, yields are, generally speaking, poor. The average yield for the coastal areas is only 15 to 20 nuts per tree per annum or an average of 1,500 nuts per acre per annum. The average number of nuts per unit weight of copra for the Malabar coast was stated to be 3,500 to 4,500 nuts per ton of copra which is equivalent to 210 to 270 nuts per picul ($133\frac{1}{3}$ lbs.) of copra and would give a yield of from 6 to 7 piculs of copra per acre.

Disposal of Crop.

The method of disposal of the crop varies in the different sub-districts. In and around Ponanni, practically the entire crop is sold in the form of nuts to dealers or agents for up-country merchants, who have set up business for this specific purpose. The dealers have middlemen who collect the nuts from villages and other convenient centres and bring them by canal or bullock cart to the wharf. The nuts are then sent to merchants in large towns such as Karachi and Bombay, where they are usually sold as fresh nuts. Sea transport is undertaken in large sailing boats or country craft, which carry up to 7,000 nuts each. Nuts are transported either whole or with the rind, but not the entire husk, removed. The price of nuts at Ponanni at the end of January, 1936, was Rupees thirty-five (Rs. 35) per 1,000 ($22.50 per 1,000). Small nuts are in demand as they are widely used for religious ceremonies in the big towns. There is, therefore, no question of two small nuts counting as one as is found in the Straits but nevertheless the peasant has to give more than 1,000 nuts for the price quoted per 1,000. The excess is supposed to cover losses caused by breakage, and the presence of empty nuts. The producer frequently parts with 1,020 to 1,060 nuts when he is paid for 1,000.

In other districts, such as Badagara, the majority of nuts are made into copra by the small-holder or the nuts are sold to Mohammadan dealers who are professional copra makers. All copra is sun-dried and carefully graded before export. A visit was made to the premises of one big dealer at Badagara. This dealer has extensive copra-drying yards and also owns a small oil mill. Four grades of copra are exported by this dealer to large towns such as Bombay, Madras and Karachi, where it is again handled for export or local consumption. The grades were as follows:—

1st grade "Boda".

This is a special grade of copra made from mature nuts which have been stored for 6 to 12 months in the husk. The unhusked nuts are usually stored in a loft, very often over the owner's kitchen quarters. During the dry season no heating or drying is necessary but during the rainy season husk or shell fires are occasionally lit underneath to prevent sufficient moisture collecting to cause germination. After six months the nuts have dried to such an extent that the meat or copra is loose inside the shell. If the nut is then husked, the shell can be cracked and the kernel falls out whole. It is then cut in half and requires but two days' sun-drying before it is ready for export. This perfect copra is sent to Bombay for local consumption and export for use in confectionery and for eating purposes generally. Current prices given by the dealer for this grade of copra were Rs. 85 to Rs. 86 per 640 lbs.

2nd grade "Madras Nottam".

This is the highest grade of copra made from mature fresh nuts and is about equal to No. 1 Estate quality copra in Malaya. Nuts are husked, split, and sun-dried for 7 to 8 days. The shell is removed after about the fourth day. The current price for this grade (1st February, 1936) was Rs. 83 per 640 lbs. This is also an edible grade of copra.

3rd grade "Dhilpasand".

This is the second grade made from fresh nuts and contains copra from mature and slightly immature nuts, but is nevertheless an edible grade. Current price was Rs. 82 per 640 lbs.

4th grade "Office Nottam".

This is the lowest grade exported and contains a good deal of copra from immature nuts. Current price was Rs. 78 per 640 lbs.

Grading is done by hand-picking. All undesirable pieces such as those which are mouldy, leathery, or otherwise unsuitable, are graded out and milled into oil at once in the dealer's own mill.

The only oil mill visited is housed in a very poor building, and consists of a battery of 10 metal *chekku* mills exactly similar in construction to the wooden *chekku* mill used by Indians in Malaya for milling gingelly and copra, but all parts are made of steel, while the pestle and scrapers are stationary and the mortar revolves. Copra can be added and cake removed without stopping the mill. The mill is driven by a main shaft from an oil engine. After sedimentation, the quality of oil appears to be quite satisfactory despite the fact that no filter is provided. A power-driven *chekku* can crush about 12 cwt. of copra in a 24 hour day.

Dealers, and exporters in Calicut, the centre of the Malabar coconut industry, stated that Malabar once produced the best copra in the world but that methods in Ceylon have improved to such an extent that Malabar cannot now compete for export of large quantities of high-grade copra of Ceylon quality.

The Coir Industry.

The importance of the coir industry can be gauged by the fact that in 1931, about 225,000 persons were engaged in the industry.

As mentioned earlier in the report, hardly a husk is wasted on the Malabar coast. Everywhere one sees signs of the coir industry—either retting pits, bales of coir yarn, bundles of fibre, or baskets of husk.

Coir-making on the Malabar coast is essentially a cottage industry. In none of the places visited were any signs of machinery for coir manufacture observed, except baling presses at some of the exporters' godowns. In practically all cases the various processes are carried out by individual peasants at or near their own houses even if it is piece work carried out for merchants who buy husks and sell the finished yarn.

Practically all the fibre exported is in the form of coir yarn, which consists of a two-ply twist about one-quarter inch diameter suitable for making into matting or into thicker ropes. There are two types of yarn exported, *viz.* soaked and unsoaked yarn. Soaked yarn is that made from husks which have been buried in retting pits for 10 to 12 months. Unsoaked yarn is that made from fresh unretted husks. Practically all unsoaked yarn is produced by the individual small-holder or his dependants whereas, in the case of soaked yarn, the husks are often bought in large quantities by dealers or merchants who arrange for the retting and then give out the work of beating, cleaning and twisting to individuals, usually old women.

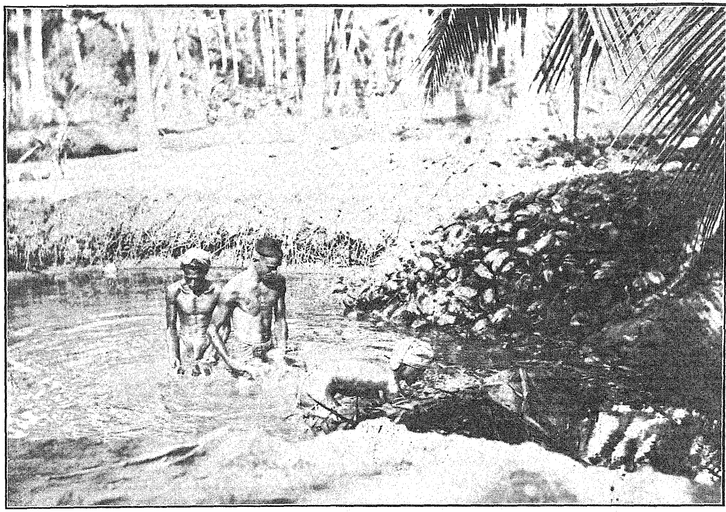
The reason why soaked yarn is not generally produced by small-holders from their own husks is that only a few holdings are suitably situated for use as retting pits, which must be near or adjoining a supply of brackish water.

Retting.

Apart from natural backwaters, only land adjoining tidal rivers or so situated that brackish water can be run in or out at intervals, can be used for retting purposes. For this reason, the production of soaked coir yarn is limited to the few small-holders who have land favourably situated and to dealers or professional coir manufacturers who can afford to rent land accessible to brackish water.

Pits are dug 6 feet deep or of sufficient depth to hold water 3 feet deep throughout the year, *i.e.* 3 feet below mean water table. The soil is usually very sandy so that free soil water movement is always taking place. This gradual movement of brackish water in and out of the pits is considered essential to the production of good colour in the fibre. Stagnant water spoils the colour of the fibre, owing, perhaps, to the concentration of the products of fermentation.

Fresh green husks, from slightly under-ripe nuts, are placed in the pits up to about 12 inches below water level, and are covered with a layer of plaited palm leaves and weighted with soil or stones to keep them from floating. It is important that fresh green husks should not be exposed to the sun too long before retting.



A Retting Pit at Ponanni. Retted husks being washed and removed from the pit.

Bales of Coir Yarn ready for shipment from the Holding to Dealers in large Towns.

Husks are left in the pits for 10 months or longer. A strong smell of hydrogen sulphide is usually apparent near the pits due to decomposition which goes on in the husk. The necessity for using husks from slightly under-ripe nuts and the fact that immature nuts will not keep for long once they have been husked has had a marked effect on the quality of the copra from coir-making districts.

Skinning and Beating.

The husks, having been removed from the pit, are handed over to women who remove the outer skin or rind and beat out the fibre by a simple but rather strenuous process, using a small round stick of hard wood or a mallet to beat the husk on a block of similar wood. The pithy matter is very quickly removed and the pure fibre remains. One woman can beat the fibre from the husks of about 100 nuts per day.

After beating, the fibre is sun-dried and either stored or immediately twisted into yarn. Properly retted fibre should not lose its golden colour on exposure during drying.

Twisting or Spinning.

This is a process requiring some skill and experience as it is nearly all done by hand. The usual method is to twist the yarn by rubbing the hands together with a circular motion taking a twist of fibre from a heap placed on either side of the spinner. The twisted yarn, consisting of a two-ply yarn about $\frac{1}{4}$ inch in diameter is extremely regular in thickness considering the way in which it is made. There is also a hand-machine for twisting yarn called a *charka*, but the writer had no opportunity of seeing one of these working. The unit of twisted yarn is a hank of approximately 132 feet. Hanks of yarn are made up into bales of 70 hanks (about 2 feet in length) weighing about 80 lbs. These bales are sold to dealers or exporters.

Unsoaked Yarn.

Unsoaked yarn is made from fresh unretted husks, and is usually made by the peasant who has no access to land suitable for retting pits. It is made in exactly the same way as soaked yarn except that the husk is severely pounded with a heavy pole or iron pestle before the outer skin or rind can be removed. Beating is much harder work and takes longer. The resulting fibre contains a considerable amount of pith and waste which would have become easily detached from retted husks. The yarn is also much softer but not so strong and is not usually a good colour. The difference in price between this and soaked yarn is only about 1 to 2 shillings per cwt. in favour of the latter.

Grading and Baling.

There are a number of European firms on the coast who deal in the yarn and grade it for export—grading is rarely done by the producer. The stores of two such firms were visited during the tour. The bales of yarn, brought in by

dealers, are weighed and approximately 50 per cent. of the estimated value paid in cash. The bales are opened up and the hanks laid out on barbecues for drying; the yarn often contains as much as 25 per cent. moisture, particularly in the case of unsoaked yarn. After drying and grading is completed, the dealer's account is settled on the actual value of yarn brought in.

The two types of yarn are graded according to quality. The various grades are named after the localities from which the particular grade originated. Quality or grade is decided on factors such as colour and twist. After drying and grading the hanks are joined together by girls and women—another skilled piece of workmanship; it is almost impossible to discern where joins have been made—and "carded" or wound into more bulky hanks on a revolving frame. Each of these hanks contains from 250 to 300 yards of unbroken yarn.

The yarn is aired and then baled in presses to reduce volume to a minimum without causing breakage of the yarn. Each bale for export weights 336 lbs.

Current prices on the London market at the time of the visit were from 16 to 18 shillings per cwt. for soaked yarn and 15 shillings per cwt. for unsoaked yarn.

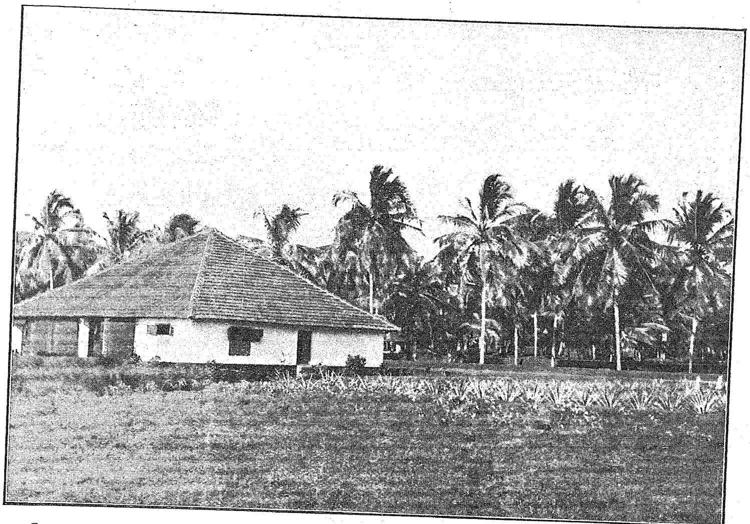
Costs and Labour.

In the case of soaked fibre, a dealer or merchant will often buy fresh husks and rent a suitable piece of land for retting pits. Fresh husks may be bought from the small-holders at Rs. 6 per 1,000 nut husks. Rent of sufficient land to soak 100,000 husks will be about Rs. 8 per annum. After 10 months' retting, the dealer may sell the husks in the pits to another dealer, who is also a professional coir maker, at Rs. 8 per 1,000 which allows a small profit on his outlay. If the dealer is a professional coir manufacturer, he hands the husks over to women for beating on contract. A woman can beat about 100 nut husks per day and is paid 2 annas 6 pies (equivalent to 10 cents Straits) per 100 nuts. It requires 4,000 to 5,000 green husks to produce 750 lbs. of beaten fibre.

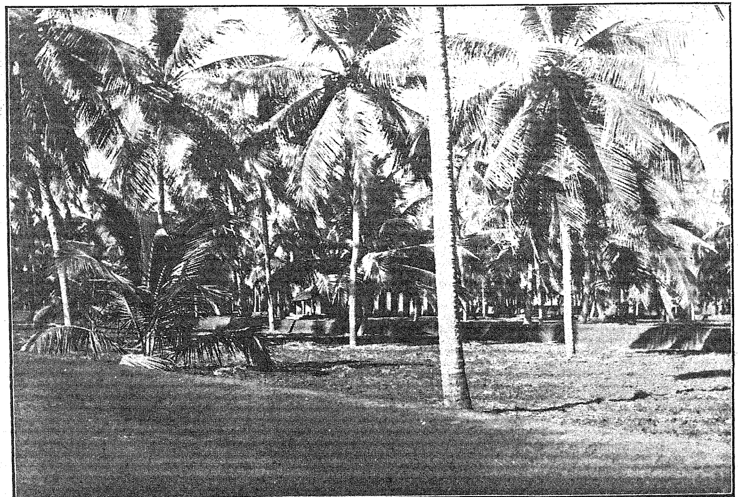
After beating and drying, the fibre is taken over by the dealer, who weighs it and hands over known quantities of fibre to women who usually take it to their homes to twist into yarn. These women are paid two pies (less than a cent Straits) per hank of 132 feet for twisting. A woman can twist from 5 to 8 hanks per day. The twisted yarn is re-weighed by the dealer when he takes it over.

Government Coconut Research Station.

This Station is about 30 acres in extent and was originally a coconut garden, taken over by Government in 1916. Planting is irregular since a considerable amount of inter-planting has taken place both before and after acquisition. The Station presents a neat and tidy appearance as it is well-bunded, which gives it a terraced effect and also divides up the Station into blocks for experimental purposes. The soil is a very light sandy loam, reddish in colour and the land has a gradual



Government Coconut Research Station, Kasaragod, South Kanara. Showing Halting Bungalow on Station, roof timbers of coconut wood from old palms cut out in 1916.



Government Coconut Research Station, Kasaragod, showing Bunding of Plots, Surface Cultivation, and deep planting of Seedlings.

slope towards the sea which is about $\frac{1}{4}$ mile distant. Bunding is necessary to prevent soil erosion during the monsoon season when over 100 inches of rain falls between the months of May and October. Cultivation is carried out by ploughing with bullocks.

Deep planting is the normal practice but there are also surface-planted palms on the Station and comparative records are being kept of both methods.

It has been found that with surface planting all palms in a given area will come into bearing in 10 years, while it takes 20 years for all palms in a similar area of deep-planted palms to come into bearing.

Individual palm records are kept in all blocks but only palms in the centre of a block are used for recording, *i.e.* a guard row is left inside all bunds. Several blocks are used for manurial and cultivation experiments, the results of which are to be published shortly.

Perhaps the most important feature of the Station is the selection work in progress. Palms are being selected for the following characters:—High yield, high production of female flowers, high setting of fruit, thick meat, large nuts.

The ideal is, of course, a combination of all five characters. It is interesting to note that it has so far been found that there is no correlation between high production of female flowers and high setting capacity. The ultimate aim is to select nuts for planting by the study of morphological characters. Another interesting observation is that development of the leaf and its corresponding spike commences at least $2\frac{1}{2}$ years before nuts on that particular spike are ready for harvesting. Individual palms on this Station have given up to 150 nuts per annum.

Every character of the palm is studied, such as nut size, yielding capacity, oil content of nuts harvested at different ages, and effect of rainfall on setting capacity.

Further results will not be alluded to here since a report on work in progress and results to-date are to be published in a few months in the form of a bulletin entitled "A Monograph on Coconuts" by Dr. Patel, the Officer of the Department of Agriculture in charge of coconut and other oil investigations.

It is of interest to record that timber from some of the old palms removed from this Station when it was first taken over has been used to build the halting bungalow on the Station and for other similar purposes.

Acknowledgments.

Certain information contained in this article, particularly that referring to areas under coconuts and average yields, which was obtained first-hand by the writer, has been checked by reference to "A Report on Coconut Enquiry in India" by Dr. J. S. Patel, M.Sc. Ph.D., to whom acknowledgment is made.

The writer wishes to express his thanks to the Director of Agriculture, Madras, (M.R.Ry. Rao Bahadur D. Ananda Rao Garu, B.Sc.) and the Deputy Director

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THE DIETETIC VALUE OF PALM OIL

BY

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Palm oil is employed for culinary purposes in regions where the oil palm is indigenous, but the cultivation of the crop in this country has not led to a similar consumption of palm oil since, as may be expected, the local races prefer the oils to which they are accustomed, coconut, groundnut, or gingelly as the case may be. Palm oil, however, has a dietetic value lacking in the other oils mentioned, in that it is a source of Vitamin A. This vitamin, which promotes growth and resistance to disease, and prevents xerophthalmia, is found in the liver oils of cod and other fish, but apparently does not occur as such in palm oil. It is produced in the body by transformation of carotene, the pigment to which the colour of the oil is due. Carotene, which is found in carrots and many vegetable products, has a chemical structure closely similar to that of Vitamin A, so that its conversion is readily explicable. The fact of conversion has been abundantly demonstrated, and a certain weight of pure carotene has been adopted as the International Unit of Vitamin A.

The value of palm oil for edible purposes, if people could acquire the taste for it, is therefore obvious, particularly as Rosedale (1) has demonstrated that its vitamin activity is not destroyed by ordinary cooking processes. Its use has also been advocated for medicinal purposes or as an adjunct to the ordinary diet, since its Vitamin A activity is more or less equivalent to that of cod liver oil. It should be clearly understood that Vitamin A alone is referred to, for palm oil is practically devoid of the anti-rachitic Vitamin D which is found in cod liver oil. Further, red palm oil only is understood, for a bleached oil has had the carotene destroyed or removed, and any palm oil much exposed to air and light will have undergone serious depletion of its carotene.

The administration of palm oil has been recommended by the medical profession on the grounds discussed above, and has had favourable results, although no large scale clinical trial has been made. The oil has been recommended by Mr. C. Ward-Jackson for puppies (2), and it has also been incorporated in poultry feeds. As is well known, palm oil deposits a solid fat at the prevailing local temperature, and this has been adduced as an objection to its consumption on human food (3). For this reason, the writer has advocated the removal of the solid fraction either by settlement or filtration, leaving a permanently fluid oil judged to be more palatable either as food or medicine (4). It was shown that the solid became progressively whiter as the liquid oil was expressed, and that the separated liquid therefore, must be richer in carotene than the original whole oil. It was further considered on general grounds that an oil of the lowest possible acidity would be most suitable; and the same idea was expressed by Mr. Ward-Jackson who suggested aiming at an acidity of $1\frac{1}{2}$ per cent.

In pursuance of these ideas, assistance was sought from the Manager of Elmina Estate who kindly produced a small batch of oil of low acidity. This oil was filtered in the laboratory, giving a liquid fraction of acidity 1.4 per cent. Samples of the oil were supplied to the Medical Officer, General Hospital, Kuala Lumpur, to the Adviser, Medical and Health Services, Singapore, and to Mr. Ward-Jackson. The second of these was examined by Professor Rosedale at the College of Medicine, who surprisingly reported that its potency was 25 per cent. inferior to that of ordinary estate palm oil obtained from Johore. Dr. Rosedale also stated that in his experience low acidity oils were usually less potent than the more acid ones.

This development was disconcerting at first sight, but since the connexion between free fatty acid and Vitamin A can only be fortuitous, it appeared that the explanation lay in the methods of producing oil of low acidity. It is well-known that with a fixed factory procedure, the acidity of the output is governed by frequency of harvesting and is reduced by shortening the intervals (5). The reason is that when harvesting at short intervals there is less opportunity for fruit to become over-ripe and susceptible to damage before sterilizing, but it also follows that there is more chance of immature bunches being included. It was fairly evident that carotene development would be incomplete in unripe fruit, and that the procedure adopted to secure oil of low acidity would tend therefore to a carotene deficiency. An actual test of different grades of fruit was arranged, to ascertain the magnitude of the differences between them.

Batches of oil were made in the laboratory, the stripped fruit being sterilized in boiling water, depericarped, and pressed in a hand press, the oil being filtered and dried *in vacuo*. The different batches were from:—

(*a*) bunches about one week under-ripe;
(*b*) bunches "just ripe";
(*c*) bunches one week over-ripe;
(*d*) as (*c*) but the stripped fruit allowed to lie about for two days before sterilizing.

The state of ripeness of bunches cannot of course be precisely defined, for any bunch bears fruits varying widely in growth and ripeness. The bunches were chosen according to the usual practical standards.

The acidities of the oils were, expressed as palmitic acid, (*a*) 1.6 per cent., (*b*) 3.3 per cent., (*c*) 3.2 per cent. and (*d*) 15.1 per cent. In appearance, the oil from unripe fruit was markedly different from the others; its colour was brownish yellow.

Samples of each oil were supplied to Professor Rosedale and to Dr. I. A. Simpson, Institute for Medical Research, for test of the Vitamin A potency, both colorimetrically and biologically. With the permission of the Director, Institute for Medical Research, Dr. Simpson carried out the desired investigation and also examined the possibilities of isolating carotene from palm oil. The results of his work are to be published in a Bulletin of the Institute, so that it is necessary here to state only the main findings.

From the effect of the samples on the growth rate of rats it was calculated that their Vitamin A potencies were as follows:—

	International Units per gramme.
(*a*) Oil from under-ripe fruit	600
(*b*) ,, ripe fruit	1900
(*c*) ,, over-ripe fruit (low acidity)	1600
(*d*) ,, over-ripe fruit (high acidity)	800

Colorimetric comparison of the oils with standard carotene gave results diverging somewhat from the above. Expressing both sets of results as milligrammes per cent. of carotene the four oils should contain:—

	By biological assay	By tintometric assay
(*a*) ...	36	24
(*b*) ...	114	66
(*c*) ...	96	62
(*d*) ...	48	60

The discrepancy cannot be explained at the moment, but a discussion of it and details of the methods will be found in Dr. Simpson's forthcoming paper.

The samples sent to Professor Rosedale were examined by him also colorimetrically and biologically but not in precisely the same manner. He compared them with his standard palm oil, expressing their Carr-Price values in terms of blue Lovibond Units per gramme. The figures were:—

	Blue Units per gramme
(*a*) Oil from under-ripe fruit	8
(*b*) ,, ripe fruit	180
(*c*) ,, over-ripe fruit (low acidity)	130
(*d*) ,, over-ripe fruit (high acidity)	135
Standard palm oil	190

For feeding rats, the oil (*a*) had little value, but (*b*) was about equal to the standard oil. Oils (*c*) and (*d*) were not distinguishable on feeding, but it was not possible to breed from the rats supplied with oil (*d*).

The interesting feature from the point of view of the present article is the confirmation of the opinion that oil from immature fruit is deficient in Vitamin A potency, and that production of low-acidity oil by methods tending to include such fruit will result in deficiency to some degree. In the case of over-ripe fruit, the carotene content seems to be largely maintained, though as far as can be judged from one set of experiments on rats the development of acidity is injurious. In the absence of scrutiny of every bunch collected after short harvesting intervals, it appears that the oil as now manufactured on most estates with an acidity of 3 to 4 per cent. will be the most satisfactory in dietetic value.

A further point is the relative value of Malayan and other palm oils compared with fish liver oils. Figures have been published indicating that the carotene content of Malayan palm oil is several times inferior to that of certain West African oils (6). Direct confirmation of this is to be sought at the earliest opportunity, but in the meantime the figures found by Dr. Simpson show that Malayan palm oil containing 1,900 International Units per gramme compares satisfactorily with cod liver oil for which values ranging from 500 to 2,800 are quoted (7). Palm oil may be regarded as equivalent to good average cod liver oil, though not equal to the best. Halibut liver oil and tunny liver oil, for which values of 41,000 and 95,000 respectively are quoted, have a potency of higher order altogether.

Thanks are due to Dr. I. A. Simpson for his collaboration in this investigation and to Dr. A. N. Kingsbury, Director of the Institute for Medical Research, for granting the facilities necessary and permitting pre-review of Dr. Simpson's paper. Professor J. L. Rosedale is also thanked for conducting a parallel series of tests.

Summary.

Red palm oil may be recommended for culinary or medicinal use on the grounds that it contains carotene, the precursor of Vitamin A. Its potency is such that it may be regarded as a good substitute for cod liver oil, at least in Malaya where there is usually no Vitamin D deficiency.

The palatableness of the oil is increased by removing the solid component, and the resulting liquid is richer in carotene than the original whole oil.

The attainment of low acidity is attended by risk, on account of the serious deficiency in carotene of immature fruit. Reduction of the harvesting interval on estates is therefore apt to be detrimental, and it is probable that, without special precautions to select ripe fruit only, it would be best to rely on oil from the normal output of estates employing bunch sterilization methods.

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NOTES ON THE PREPARATION OF DERRIS ROOT FOR EXPORT TOGETHER WITH A SUGGESTED METHOD FOR EVALUATION

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Introductory.

While correct comparative evaluations of the toxicities of roots of various species of Derris can be obtained only as a result of controlled experiments on different classes of insects, chemical tests constitute the means by which commercial consignments are valued. Thus, at present, the rotenone content and/or the ether extract of the root are invariably used as a basis for valuation purposes.

The adoption of a chemical test raises the question of a standard method of procedure for sampling and analysis to ensure comparable results being obtained by different workers.

Although this question has already been discussed in some detail (1), the growing importance of Derris and the increasing competition to be met from other plants, notably cubé root (*Lonchocarpus* sp.), possessing similar insecticidal properties, justify reconsideration of the subject.

In the present paper, therefore, an account will be given of various experiments carried out recently with Derris root, mainly with the object of standardizing the method of analysis. Further, since the investigation comprised the examination of roots from the more important species of Derris now under cultivation, it will be possible to indicate the quality of root at present being exported from Malaya.

General Considerations on Preparation of Root for Export.

Apart from the question of moisture content to which reference will be made later, two other important points affecting the quality of the root have emerged as a result of the examination of a large number of commercial samples.

(a) *Washing of Roots.*—The freshly-harvested roots should be washed free from soil before being dried. Although a large proportion of the naturally-adhering soil falls away during the process of drying, there is always a tendency for some to adhere tenaciously if the soil is of a clayey nature, thereby detracting from the appearance of the roots. In such cases the latter will be described subsequently as dusty.

Provided that the cortex has not been injured during harvesting, there is no danger of loss of toxic substances in washing the fresh root with water.

(b) *Selection of Roots.*—In general, only roots with a diameter of half-an-inch or less should be included, the final selection being made when the material

is dry. Roots shrink in size perceptibly on drying, so that if selection is carried out with freshly-harvested material, a proportion of roots which would satisfy the above standard will be excluded.

Some contracts specify a maximum diameter in the air-dry roots of 10 mm., corresponding approximately to 0.4 inches.

In addition, inspection of a large number of commercial consignments has shown that there is a tendency not to harvest the roots to the tips; frequently many roots are found to have been broken off during the process of harvesting. Further, the opinion has been expressed that the very fine roots are deficient both in rotenone and in ether extract.

A series of experiments was therefore carried out with the root systems from plants of various species of Derris to determine the rotenone content and ether extract of roots of varying sizes and the percentage distribution of rotenone and ether extract in the root systems.

The root systems from the individual plants of each species were air-dried, bulked and the roots separated into the following sizes (i) $\frac{1}{2}$ inch to $\frac{1}{4}$ inch (ii) $\frac{1}{4}$ inch to $\frac{1}{8}$ inch (iii) $\frac{1}{8}$ inch and less. The weights of the roots were recorded in each case, after which average samples were drawn for analysis.

The results in Table 1 show that the toxicities of the smallest sized roots compare favourably with those for larger roots; in one instance, *D. elliptica* (Singapore type), the toxicity of the roots having a diameter of $\frac{1}{8}$ inch or less is greater than that of roots varying in diameter from $\frac{1}{4}$ to $\frac{1}{8}$ inch. In this connexion it may be mentioned that the term toxicity applies equally well to the ether extract and to the rotenone content.

Further, the figures in Table II indicate that the smallest sized roots may amount to a considerable proportion of the total yield. Coupled, therefore, with the high toxicity, the results illustrate the importance of harvesting the root systems of the plants as completely as possible.

In addition, the figures also show the absence of any grounds for the attitude adopted by some dealers that the very fine roots are of poor toxic quality, and that they are in consequence justified in offering a much reduced price compared with the larger roots.

Methods of Analysis.

In view of the advisability of the adoption of a standard method for the valuation of the roots on a chemical basis, the various operations involved will be considered in order of sequence:—

(i) Selection of sample.
(ii) Preparation of root for analysis.
(iii) Determination of moisture.
(iv) Determination of ether extract.
(v) Determination of rotenone.

Table I.

Rotenone Content and Ether Extract of Roots of Varying Sizes from Different Species of Derris.

(Moisture-free Basis)

Species of Derris	Rotenone			Ether Extract		
	Roots $\frac{1}{2}''$—$\frac{1}{4}''$	Roots $\frac{1}{4}''$—$\frac{1}{8}''$	Roots $\frac{1}{8}''$ and less	Roots $\frac{1}{2}''$—$\frac{1}{4}''$	Roots $\frac{1}{4}''$—$\frac{1}{8}''$	Roots $\frac{1}{8}''$ and less
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
D. elliptica (Singapore type)	No roots	3.91	5.77	No roots	20.80	21.82
D. elliptica, Sarawak creeping	4.07	7.18	5.64	18.31	26.57	21.42
D. malaccensis var. *sarawakensis*	3.04	2.98	2.76	22.66	20.88	18.77
D. malaccensis (Kinta type)	Nil	Nil	Nil	11.44	14.57	12.43

Table II.

Distribution of Rotenone and Ether Extract in Roots of Varying Sizes from Different Species of Derris.

(Moisture-free Basis)

Species of Derris	No. of Plants	Proportion of Roots			Distribution of Rotenone (expressed as percentage of total present)			Distribution of Ether Extract (expressed as percentage of total present)		
		Roots $\frac{1}{2}''$—$\frac{1}{4}''$	Roots $\frac{1}{4}''$—$\frac{1}{8}''$	Roots $\frac{1}{8}''$ and less	Roots $\frac{1}{2}''$—$\frac{1}{4}''$	Roots $\frac{1}{4}''$—$\frac{1}{8}''$	Roots $\frac{1}{8}''$ and less	Roots $\frac{1}{2}''$—$\frac{1}{4}''$	Roots $\frac{1}{4}''$—$\frac{1}{8}''$	Roots $\frac{1}{8}''$ and less
		per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
D. elliptica (Singapore type)	3	No roots	44.5	55.5	No roots	33.8	66.2	No roots	43.3	56.7
D. elliptica, Sarawak creeping	3	19.5	48.2	32.3	13.1	56.9	30.0	15.3	54.9	29.8
D. malaccensis var. *sarawakensis*	4	17.7	38.7	43.6	18.5	40.0	41.5	19.7	40.4	39.9
D. malaccensis (Kinta type)	2	37.9	37.9	24.2	Nil	Nil	Nil	33.7	42.9	23.4

(i). Selection of Sample.

The importance of accurate sampling cannot be over-estimated in view of the wide variations existing beween the toxicities of the roots from individual plants. The figures in Table III illustrate the range of variation found for the more important species.

Table III.

Variations in Ether Extract of Roots of Individual Plants of Various Species of Derris.

(Moisture-free Basis)

Species of Derris	No. of Plants	Maximum	Minimum	Average
		per cent.	per cent.	per cent.
D. elliptica (Singapore type)	21	25.10	11.14	20.52
-do-	20	28.00	18.82	23.89
D. elliptica, Sarawak creeping	36	29.65	5.08	24.71
D. malaccensis var. *sarawakensis*	47	26.83	14.78	21.31
-do-	40	25.65	6.13	19.44
D. malaccensis (Kinta type)	22	22.07	14.41	18.79

The results indicate clearly the necessity for a definite sampling procedure if reliance is to be placed upon the results of the subsequent chemical analysis.

There are two essential principles in sampling:

(*a*) Samples must be drawn at regular intervals during the process of packing the consignment.

(*b*) A constant proportion must be maintained between the amount of the sample and the quantity sampled. If possible, the amount of the sample should be not less than one half per cent. by weight of the material sampled.

The general method of packing derris root is in bales, which are press-packed to save space, and samples may be taken while baling is being carried out or when the root has already been baled.

In the first case, it is suggested that, as the root is loaded into the baling press, individual pieces be taken at random at regular intervals so that by the time the press has been loaded, a further amount of root equal to one half per cent. by weight of the bale has been set aside for sampling. For example, in

the case of a bale of 200 lbs. the amount withdrawn for sampling would be 1 lb. A similar procedure would be followed in the case of the other bales.

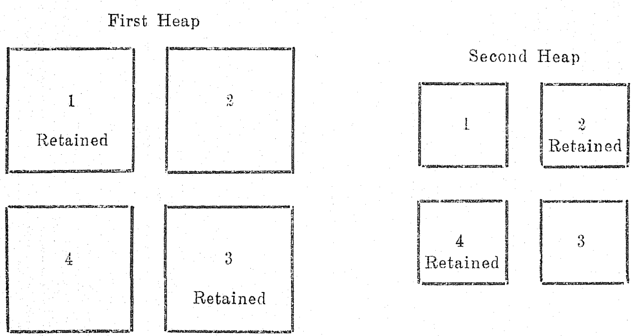
The bulk sample of root should then be chopped into lengths of approximately 6 inches, and the mass mixed and quartered until about 1 lb. of root remains. This amount will be ample for submitting for analysis.

The quartering of the bulk sample is carried out as follows: The mass of root, which has been cut into short lengths, is mixed thoroughly, and the heap smoothed out into the form of a square. The heap is divided by means of a wooden rod into four equal portions as indicated in the diagram. The material in opposite quarters, *i.e.* 1 and 3 or 2 and 4 is mixed and made into a fresh heap; that in the other pair of opposite quarters is set aside.

A similar procedure is followed as regards the second heap of material, except that the root in the pair of opposite quarters set aside on the first occasion is retained. This procedure of selecting material in alternate pairs of opposite quarters is repeated until the requisite amount of root, say 1 lb., remains.

DIAGRAM I.

Method of Quartering Used in Sampling.



Although in the case of a large consignment, say 2 tons, a comparatively large amount of root, approximately 23 lbs., is drawn originally for the purpose of obtaining a representative sample, the total amount eventually retained is only about 1 lb. All the root set aside during the process of sampling can be incorporated in one of the bales.

If the root has been packed the opening of individual bales is necessary. In this case it is suggested that 10 per cent. of the bales be opened, and 5 per cent.

by weight of each bale selected for sampling, care being taken to remove individual pieces of root from different parts of the bale.

The samples from the individual bales, equivalent to one-half per cent. by weight of the whole consignment, are bulked, the root chopped into short lengths, and the heap quartered as described previously until approximately 1 lb. of root remains.

To increase the accuracy of the method the bales for sampling should be selected according to a definite procedure. The bales should be numbered serially, and the consignment divided into as many groups as there are bales to be opened, one bale in each group being selected. A definite interval of choice, equivalent to the number of bales in the group, should also be maintained between the selected bales in the individual groups.

An example will make the method clear. A consignment consists of 40 bales, numbered from 1 to 40 inclusive, and the number of bales to be opened is 4. The consignment is divided into 4 groups, each group consisting of 10 bales, *i.e.* 1-10, 11-20, 21-30, 31-40. The interval of choice is 10. Any bale in the first group may be selected, for example No. 4, and by successive additions of 10, the interval of choice, the serial numbers of the succeeding bales are determined, *i.e.* bales, 4, 14, 24, 34.

As regards baled roots, the above method would only be applicable if there were facilities for baling the roots again after sampling had been completed.

It will be realized, therefore, that the more convenient method of drawing an average sample of root is preparatory to baling when the root is loose and individual pieces can be selected without difficulty.

The last point is emphasized, since it has been brought to notice that wide variations in toxicity have been found between samples drawn from different parts of a bale.

(ii). Preparation of Root for Analysis.

The following is a brief account of the method at present in use. Fresh roots are sun-dried until they can be broken without exudation of plant-juices. The semi-dried roots are then cut into pieces varying from $\frac{1}{4}$ to $\frac{1}{2}$ inch long and the chopped material is further sun-dried until of constant weight.

The material is then quartered for analysis until approximately $\frac{1}{4}$ lb. remains. One hundred grammes are weighed, then ground in a drug mill.

The root is first passed through a disintegrator having spaces 1/32 inch wide, the spaces being approximately $\frac{1}{4}$ inch apart. The material is ground a second time, the disintegrator being replaced by a 1 mm. sieve. The small amount of woody matter remaining is ground separately in a smaller mill and incorporated with the main sample.

During the process of grinding the root, a considerable proportion of the fine fraction passes through into the canvas bag fitted to the mill. Since this fine dust contains a high proportion of solvent soluble material, care must be taken to empty the bag completely on the conclusion of the operation and to recover all the dust. The latter must be reincorporated with the rest of the material.

For example, in one experiment the mixed ground root was passed through a 100 mesh sieve and portions of the two fractions extracted with carbon tetrachloride. The material passing through the 100 mesh sieve corresponds approximately to the fine fraction referred to above.

The results of analysis, calculated on a moisture-free basis, were as follows:—

	per cent.
Coarse fraction	12.3
Fine fraction	33.0

It will be seen, therefore, that the amount of solvent extract in the fine fraction is nearly 3 times as much as in the coarse fraction.

To obtain a representative sample of the ground root for analysis, the various fractions are shaken together in a jar provided with a closely-fitting lid, and the required amount of material is weighed before segregation of the fine particles has taken place.

The weight of the finely ground material is checked against that of the original root. There is usually a difference of 1 per cent. in the weights; this can be attributed only to a slight reduction in moisture content consequent upon a rise in temperature of the material during the process of grinding.

(iii). Determination of Moisture.

The moisture content of the root is of considerable importance from the point of view of valuation of product, the ether extract or rotenone content of the same material varying inversely as the moisture.

Apart, therefore, from the questions of risk of mould development and deterioration in quality consequent upon packing moist material, the producer is well-advised to ensure that the root is air-dry before sale.

The moisture content of the air-dry root varies from 7 to 10 per cent., the lower figure being found during the dry, and the higher figure during the wet season.

Even though the roots are air-dried before despatch, a further small loss in weight will occur during transit, owing to the slow drying out of the material consequent upon less humid atmospheric conditions. This small reduction in moisture content is inevitable, and is a recognized feature in the shipment of other products, for example, palm kernels.

With air-dry roots the loss in weight is not serious and, even with roots harvested in the wet season, the amount is only approximately 4 per cent., calculated on the original weight. The loss should not, however, exceed 2 per cent. for roots packed in the dry season.

If, therefore, roots are despatched without being adequately dried, in addition to an excessive loss in weight in transit for which the exporter will be penalized, the buyer receives the benefit of an increase in the amount of ether extract and/or rotenone content, consequent upon the reduced moisture content of the material. It is therefore essential for the producer in his own interests to ensure that the root is dry before sale. This point cannot be emphasized too strongly, since

samples from commercial consignments have been received in which moisture contents of 12 and even 14 per cent. have been recorded.

As regards determination of moisture, all samples of root are weighed on arrival, any loss in weight occurring before the sample for analysis is drawn, being calculated as moisture, and an adjustment made when the moisture content of the finely-ground material has been determined.

In those cases, however, in which only a moisture determination is required, the most convenient method is to distil the finely-chopped root with xylene, measuring the amount of water which collects on distillation.

Similarly, the moisture content of the finely-ground root may be determined either by distillation with xylene or by drying to constant weight in the steam-oven at 100°C.

The results of our experiments have shown the method of distillation to be preferable owing to the elimination of any oxidation effect due to heating in air material in a finely-ground condition (1). The distillation method is therefore used when dealing with individual samples; where large numbers of samples are involved, however, the alternative method is employed by reason of a more rapid rate of working.

(iv). Determination of Ether Extract.

Although different solvents have been suggested for the determination of the amount of extract (1), ether is the solvent invariably specified when selling the root under contract.

A weighed amount, approximately 5 grammes, of the finely ground root is treated with ether in a Soxhlet extractor for 16 hours at a temperature just sufficiently high to allow the solvent to boil gently.

Experiments have shown that with this amount of material, the above period is sufficient to ensure complete solvent extraction, no appreciable quantity of extract being recovered on grinding the residue with a small proportion of sharp sand, and extracting the mixture with more ether.

The ethereal solution is filtered if necessary to remove traces of suspended matter, the solvent distilled off and the residue dried to constant weight in the steam-oven, weighings being recorded every two hours.

Although the results of our experiments have shown that slight chemical changes take place by drying the ether extract under such conditions and it would therefore be preferable to dry to constant weight *in vacuo*, the method of drying in the steam oven has the advantage of being more rapid, constant weight being reached usually after heating for 6 hours. This method is therefore invariably used when determining the amount of extract in the root.

(v). Determination of Rotenone.

The question of an accurate method for the estimation of rotenone is of the utmost importance in view of the higher price paid for root on this basis compared with ether extract. At present, root sold on a rotenone basis is valued at $48 per picul, compared with $33 per picul for that sold on an ether extract basis.

Unfortunately no specific quantitative chemical reaction is yet known by means of which rotenone can be separated as a complex or compound in a high state of purity from the other substances with which it is associated, and the methods at present in use depend in the original instance upon crystallization from a cold concentrated solvent extract of the root. In general, one of two solvents is employed, ether or carbon tetrachloride. In the case of ether, rotenone crystallizes as such, but with carbon tetrachloride, rotenone separates as a complex containing one molecule of solvent of crystallization.

Although rotenone is an easily crystallizable substance the crystals will occlude a varying proportion of the substances dissolved in the mother liquor. These substances consist principally of uncrystallizable resins. The latter cannot be removed entirely by washing the crystals with fresh solvent, partly owing to the risk of dissolving some of the rotenone, and partly owing to the presence of some of the mother liquor within the crystal agglomerates.

It will be realized also that the greater the degree to which the solution is concentrated before crystallization the greater the chances of contamination. The degree of concentration necessary for satisfactory crystallization varies with the proportion of rotenone to total extract. It can be calculated, for example, that with root of *D. malaccensis* var. *sarawakensis* yielding 20 per cent. of extract the concentration of the solution before crystallization will amount to approximately 40 grammes per 100 cc., assuming 50 grammes of the root to have been used and the volume of the extract reduced to 25 cc.

Any method which depends solely on the weight of a crude crystalline product must yield variable results in the hands of different workers owing to differences in the conditions of the experiment, for example, the degree of concentration before crystallization occurs, the rate of crystallization, and the amount of solvent used in washing the crystals.

Further, in the writers' opinion it is unfair to base the price of the root on a figure for the weight of a compound of an unknown degree of purity.

A standard method of determination is therefore urgently required so that comparable results may be obtained by different workers.

The following method, using carbon tetrachloride as a solvent, has been tentatively adopted in this Department. The method, which gives concordant results, is based on that already published (1), the chief difference being that trituration of the crude carbon tetrachloride complex with cold alcohol as described by Cahn and Boam (2), has replaced recrystallization from boiling alcohol.

From 20 to 50 grammes of the finely-ground root, the amount being based on the approximate rotenone content if known, are weighed out and extracted with carbon tetrachloride for 8 hours in a Soxhlet extractor. The thimble is removed from the extractor, the partially exhausted powder dried, lightly ground in a mortar and replaced in the thimble. Extraction is continued for a further 8 hours, making 16 hours in all.

The solution is filtered and concentrated to a point at which it commences to thicken. The solution is allowed to cool to air temperature and, if there is no

tendency for the solution to crystallize, a few crystals of pure rotenone are added to induce crystallization. The flask is corked and allowed to stand in the cold cabinet overnight at a temperature of approximately 5°C.

The crystalline precipitate (which consists of an impure rotenone-carbon tetrachloride complex) is filtered on a tared Gooch crucible, using a paper-disc filter, and washed with 10 to 15 cc. of ice-cold carbon tetrachloride according to the amount of the precipitate.

The crucible containing the precipitate is allowed to stand in the air for 24 hours, after which the contents are transferred to a mortar and ground to powder. The powdered material is replaced in the crucible and allowed to stand in the air till the weight is constant. A period of 3 hours is usually sufficient.

The weight of the complex should not exceed 4 grammes, otherwise there will be difficulty in washing the precipitate satisfactorily. The amount of root originally weighed out should be adjusted accordingly.

The carbon tetrachloride complex is transferred to a flask and triturated with 95 per cent. alcohol saturated with rotenone in the proportion of 5 cc. of alcohol to 1 gramme of complex.

The flask is allowed to stand overnight and the crystalline rotenone precipitate filtered on a tared Gooch crucible, using a paper disc filter. The precipitate is washed with alcohol saturated with rotenone until the filtrate is colourless. Usually 10 to 15 cc. are sufficient. The precipitate is dried in the steam-oven to constant weight.

The above method works satisfactorily with all species of Derris in which the rotenone content exceeds 15 per cent. of the solvent extract. In the case, however, of *D. malaccensis* (Kinta type) in which the proportion of rotenone is of the order of 2 per cent., crystallization of the carbon tetrachloride solution must be induced by the addition of an amount of rotenone sufficient to raise the proportion of that substance to approximately 30 per cent. The latter figure represents approximately the proportion of rotenone present in the extract from *D. elliptica* (Singapore type), with which no difficulty is ever experienced as regards crystallization of the carbon tetrachloride complex.

The necessity for the addition of rotenone to induce crystallization as described above was originally mentioned by Cahn and Boam and acknowledgment of their work is hereby made (2).

To give an indication of the accuracy of the above method the following figures which were obtained as a result of quadruplicate analyses of one sample may be quoted: 7.61, 7.71, 7.60, 7.51, average 7.62 per cent.

Although the method yields concordant results it is possible that the final figure may not represent the total rotenone content of the root but rather the amount of rotenone that can be recovered under the conditions of the experiment. Rotenone may be lost at one or two stages of the process, thus some may not crystallize out from the carbon tetrachloride but may remain associated with resinous bodies in the mother liquor, while some may pass into solution when the

complex is triturated with alcohol. While our experiments have shown that these losses are not likely to be serious the questions are considered of sufficient importance to warrant further investigation.

From the point of view of a commercial valuation, a marked disadvantage of the method is the length of time which the process occupies, and the opinion has been expressed that it might be possible to adopt the weight of the air-dry carbon tetrachloride complex as a standard for calculating the weight of rotenone after the introduction of an appropriate correction factor. This would also obviate one source of loss of rotenone. In the case of the pure complex the weight of pure rotenone can be calculated by multiplying the weight of the complex by the factor 0.719.

Experiments have shown that the purity of the complex varies both with roots from the same species and from different species. For example, in a series of 21 determinations of rotenone in *D. elliptica* (Singapore type) the proportion of the recovered weight of rotenone to the weight calculated from that of the complex varied from 66.3 to 87.2 per cent., with an average of 80.3 per cent. Further, in the case of *D. malaccensis* var. *sarawakensis* the proportion does not exceed 70 per cent.

Apart from the question of the possibility of a small loss of rotenone on treating the complex with alcohol, it is considered that the range of variation of purity of the complex is too wide to admit of the introduction of a correction factor and, therefore, it is impossible to recommend the weight of the complex as a standard on which to base the rotenone content. While the result would favour the producer, the figure would be fictitious and might well give rise to a complete misunderstanding as regards the value of a consignment of root if the buyer contemplated the recovery of rotenone.

A similar suggestion was made when ether was being used as a solvent, the weight of the crude crystalline precipitate being taken as a basis for calculating the rotenone content. It has been shown previously (1) that such a procedure is also unsatisfactory owing to the variation in the degree of purity of the precipitate.

Unfortunately the weight of the crude carbon tetrachloride complex is being often used at present as a basis for calculation, thereby accounting for an undue apparent richness in rotenone in some samples of root. In this connexion it may be mentioned that in another series of samples of *D. elliptica* (Singapore type) in which the figures for rotenone, weighing the recrystallized product, varied from 6.00 to 7.16 per cent., those based on the weight of crude complex varied from 7.13 to 10.76 per cent.

The importance of the adoption of a standard method for the estimation of rotenone, in which the latter is weighed as a pure product, is urged most strongly, as it is maintained that the interests of the industry would best be served by adopting a method which would place the determination of this relatively important

constituent on a basis in which purity of product as judged by the present accepted standards would be unquestioned.

Observations on Present Quality of Malayan Derris Root.

The three principal centres in which this crop is at present being cultivated are Johore, Perak and Singapore, of which the most important is Johore.

According to the returns for 1935 the total area planted in Malaya amounted to 6,439 acres, the details for the respective centres being as follows:—

Centre of Production		Area Planted	Proportion of Total Area
		acres	per cent.
Johore	...	3,918	60.8
Perak	...	1,028	15.3
Singapore	...	750	11.6

As far as can be ascertained, *D. elliptica* (Singapore type) is the species commonly cultivated both in Johore and Singapore, while in Perak the species is *D. malaccensis* (Kinta type).

Reference to previous work (3) (4) will show that bulk samples of *D. elliptica* (Singapore type) are generally characterized by a high rotenone content combined with a high ether extract.

The results of analysis of samples from Changi, Singapore, show that the composition of the air-dry root from plants harvested at 18 months intervals varies as follows:—

				per cent.
Rotenone	...	...	...	5 to 6
Ether Extract	...	...	...	18 to 22

There should be, therefore, little difficulty in this root meeting the present requirements of the market as far as rotenone content is concerned, the present standard for which is either 4 or 5 per cent., usually the latter. The root would also satisfy the standard if sold on an ether extract basis, which is generally fixed at 18 per cent.

Frequently, however, consignments of roots of this species are offered in which both the rotenone content and the ether extract are below these figures. Assuming that sampling has been carried out satisfactorily, the lower figures can be ascribed either to the age of harvesting or to a poor strain of plant. The question of the variation in toxicity between individual plants has already been discussed (4).

D. malaccensis (Kinta type) is characterized by a very low rotenone content, combined with a moderately high ether extract. For practical purposes the root may be regarded as rotenone-free, the rotenone content seldom exceeding 0.5 per cent. The ether extract of the air-dry root is approximately 18 per cent., so that this species can also satisfy the market requirements for root sold on an ether extract basis.

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3. Georgi, C. D. V., Greig, J. L. and Gunn Lay Teik. Varietal and Manurial Trials with Derris. *Malayan Agricultural Journal*, Vol. XXIV, No. 6, June 1936, page 268.
4. Georgi, C. D. V., Lambourne, J. and Gunn Lay Teik. Preliminary Selection Experiments with Derris. *Malayan Agricultural Journal*, Vol. XXIV, No. 8, August 1936, page 374.

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Abstract.

TWENTY-SEVENTH REPORT ON NATIVE RUBBER CULTIVATION IN THE NETHERLANDS INDIES.*

Prices.

The Batavia quotation for Java standard sheet at the beginning of the quarter under review was 23 guilder-cents per $\frac{1}{2}$ kgm. By the middle of April it went up to $23\frac{3}{4}$ cents, but towards the end of the month it dropped again to 23 cents. During the first half of May the price continued to decline until it reached $22\frac{1}{2}$ cents around the 12th of the month; during the second half of May, the quotation fluctuated several times between $22\frac{3}{4}$ and $23\frac{3}{8}$ cents, to stand again finally at 23 cents at the end of the month. During the month of June the quotation moved sharply upwards and reached the level of $23\frac{7}{8}$ cents on June 26th. In the first half of July a further advance followed to $24\frac{1}{2}$ cents.

The half-monthly averages of the daily quotations for Java standard sheet at Batavia in the period from April 1st to July 15th were consecutively: 23.3, 23.5, 22.8, 22.9, 23.1, 23.2 and 24.1 guilder-cents per $\frac{1}{2}$ kgm.

During the quarter under review prices were considerably higher than those in the preceding quarter. The somewhat weaker tendency in May is a result of two factors, namely, the decision of the International Rubber Regulation Committee made on April 28th to reduce the restriction percentage for the second half of 1936 from 40 to 35 per cent., and the outcome of the election in France, from which a possible devaluation of the franc was anticipated. The internally sound position of the rubber market, however, again resulted in a price recovery. A great stimulus was given by the satisfactory progress of consumption in the United States and by the steady decline in the stocks of rubber.

The trend of prices was always closely followed by increases and decreases in the extraordinary export duty on native-grown rubber. In the early part of April the tax in force was 33 cents per kgm. dry native-grown rubber. The advancing prices in the beginning of the quarter under review caused it to be raised to 34 and 35 cents on April 6th and April 19th respectively. The price decline in the first half of May was followed by reductions on May 8th and May 11th to 34 and 33 cents respectively. On May 19th, however, the export tax was again raised to 34 cents. The continued price advance in June, and particularly towards the end of the month and the beginning of July, made further increases necessary, namely to 35 and 36 cents on June 24th and July 9th respectively. The difference between the price of standard sheet at Batavia and the extraordinary export duty was thereby retained at about 7 cents per $\frac{1}{2}$ kgm.

The prices of medium blanket in Singapore fluctuated, during the quarter under review, between the price of standard sheet and a level $1\frac{1}{2}$ per cent. below this.

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* Abstract from *The Netherlands Indies,* Vol. IV Nos. 14-15, August 1, 1936.

Table I.

Quarterly Exports of Native-grown Rubber in Metric Tons.

(dry equivalent).

	Group Ia blankets	Group Ib sheets	Group IIa scraps	Group IIb slabs	Total	Ia + Ib in per cent. of total
1935						
1st quarter ...	8,299	7,924	953	18,863	36,039	45.2
2nd „ ...	13,851	15,508	1,009	20,646	51,014	57.7
3rd „ ...	10,230	9,514	19	8,097	27,860	70.9
4th „ ...	13,104	12,452	16	4,361	29,933	85.4
Total ...	45,484	45,398	1,997	51,967	143,846	62.7
1936						
1st quarter (final figures) ...						
Acheen ...	4	24	—	50	78	36.0
Sumatra's East Coast ...	1,617	472	76	2,191	4,356	48.0
Tapanuli ...	343	885	—	1	1,229	100.0
Sumatra's West Coast ...	369	8	—	10	387	97.0
Rhio ...	—	1,871	86	295	2,252	83.0
Banka ...	—	354	—	1	355	100.0
Djambi ...	1,386	3,582	—	148	5,116	97.0
Palembang ...	2,023	183	—	3,675	5,886	37.5
Western Borneo ...	4,172	5,190	—	—	9,362	100.0
S. & E. Borneo ...	5,204	2,504	—	487	6,195	92.5
Total ...	13,123	15,073	162	6,858	35,216	80.1
2nd quarter (provisional)						
Acheen ...	1	36	—	15	52	71.0
Sumatra's East Coast ...	1,223	309	22	2,403	3,957	38.7
Tapanuli ...	414	703	—	—	1,117	100.0
Sumatra's West Coast ...	513	9	—	27	549	95.0
Rhio ...	—	1,720	112	782	2,614	65.8
Banka ...	—	569	—	—	369	100.0
Djambi ...	1,708	4,086	—	140	5,934	97.6
Palembang ...	2,215	91	—	3,285	5,591	41.2
Western Borneo ...	4,043	5,795	—	—	9,838	100.0
S. & E. Borneo ...	4,196	3,952	—	227	8,375	97.3
Total ...	14,313	17,070	134	6,879	38,396	81.7

Exports.

During the second quarter of 1936 exports of native-grown rubber amounted to 38,398 tons,* an excess of 1,564 tons over the allotted quota of 36,834 tons.†

During the entire first half of 1936, exports totalled 73,584 tons, (excluding the 30 tons which were for the account of the 1935 restriction year), or 83 tons below the allotted quota of 75,667 tons, so that it may be said that the allotted quota has practically been filled.

In this connexion, it should be pointed out that the regions with individual restriction have exported less than the allotted quota.

In Table 1 a review is given of the quarterly exports of native-grown rubber, divided into the four groups that are classified in the export statistics.

Compared with the first quarter of 1936, the share of dry rubber in the exports has increased slightly during the second quarter, namely from 80.1 per cent. to 81.7 per cent. The increase in exports is entirely accounted for by groups Ia and Ib, blankets and sheets, the exports of groups IIa and IIb, scraps and slabs, together remaining fairly constant.

The exports of these types of dry native-grown rubber are still finding their way largely to Singapore and Penang. Direct exports of native-made sheets to the United States show, however, quite a steady and not insignificant increase.

Registration of Native Plantations, and Experimental Tappings.

The registration of native rubber plantations is progressing satisfactorily. It is expected that the greater part of the field work of the 135 enumeration brigades will have been completed by the end of August. As already stated in the previous report, the data received in Batavia are being regularly compiled in the Central Bureau for Native Rubber Registration into the regional card and punch-plate registers that are required for the introduction of the restriction on an individual basis.

The preliminary results of the 850 experimental tappings required for the interpretation of the plantation data collected have already been worked up. In order to obtain as reliable an insight as possible into the factors which might affect production it was decided that a large number of experiments be continued till the end of 1936.

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* Provisional figures, since the figures for June are not yet final.

† In this export quota, the increase in the Netherlands Indian basic quota, which has entirely been devoted to the advantage of the native quota, and the cancelling as a liability, at the end of 1935, of the amount exported by the Netherlands Indies in excess of its export quota have been taken into consideration.

Review.

Two Insects of the Vanda Joaquim Orchid Flower.

By G. H. Corbett, Government Entomologist, and Abu Hassan, Malay Agricultural Assistant. The M.A.H.A. Magazine, Vol. VI, No. 4, October, 1936.

In this paper, the writers discuss in non-technical terms two insects, one a beetle, *Lema pectoralis* Baly, and the other a thrips, *Anaphothrips corbetti* Priesner, which are always associated with the flower of the Joaquim orchid unless careful attention is bestowed on their control.

The brief descriptions and illustrations of the egg, grub, cocoon and adult will enable the reader to identity the stages of the beetle; the notes on the life history of the beetle and of a parasite of the grub will be found interesting, and the control measures consisting in the collection of all stages of the beetle will, it is stated, prove satisfactory.

The thrips, *Anaphothrips corbetti* Priesner, has only comparatively recently been associated with the Joaquim orchid and in those gardens where tuba is regularly used resulting in the production of perfect orchid blooms, this is, quite unknowingly, probably due to the control of this insect. This thrips is very minute but its presence is readily revealed by small malformed flowers with a brownish discolouration of the petals and, in severe infestations, by yellow and black buds and by a brownish scabby appearance of the flower stem.

Whilst hand collection of all stages for the control of *Lema pectoralis* is recommended, spraying with either a soap, tuba or nicotine sulphate solution for the control of *Anaphothrips corbetti* is advised.

This is a useful paper which will be found of considerable interest to lovers of the Vanda Joaquim and other orchids in Malaya.

(*Contributed*).

DERRIS CULTIVATION IN PERAK.

Malayan Agricultural Journal, September 1936.

The author wishes to make it clear that the possibility of assigning the Kinta Derris to the species *malaccensis* has occurred to other workers in this field. Recent work (to appear as part of an article in the *Journal of the Society of Chemical Industry* by Dr. Buckley of this Department) lends support to this indentification on biochemical grounds. The article was concerned only to suggest identity with the particular type originally described by Prain as *D. malaccensis*.

J. N. M.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports from Agricultural Officers.

September 1936.

The Weather.

With the exception of a few areas the rainfall for September was below the average for the month throughout the Peninsula. Spells of dry weather, unusual for September, occurred in many areas; in Province Wellesley, for instance, intermittent rain fell during the first half of the month, followed by a dry period until the last few days of the month, when heavy showers fell. On the other hand, most of Selangor's rain fell during the second and third weeks of the month.

Exceptions to the general sub-normal rainfall are provided by Kedah, where precipitation was well above average and the Jelebu and Kuala Pilah Districts of Negri Sembilan.

Remarks on Crops.

Padi.—In Kedah, planting was completed in the north and proceeded well elsewhere under satisfactory conditions. Heavy rainfall coinciding with high tides caused some flooding in Kota Star and Kuala Muda Districts, but the plants were sufficiently large to withstand it without much damage. In Province Wellesley, the low rainfall delayed planting somewhat, but in the earlier planted areas the crop has made satisfactory growth. The shortage of water in the south-eastern portion of Krian District of Perak has resulted in delayed planting, a check in growth of such of the crop as had already been planted and renewed weed growth on many areas which occasioned a second or even third *tajak*. Planting was also late in the north-west of the District, although this area did not suffer from water shortage to the same extent. In Perak North and Central, planting has been completed or is nearing completion. Water shortage has occasioned delay in a few areas. In the Sungei Manik area of Lower Perak, planting has proceeded steadily and under generally satisfactory conditions in Stage I. In Stage II, however, irregularities in levels over the area have shown that considerably more internal bunding than has been done on Stage I will be necessary to make satisfactory use of the irrigation water which is available in sufficient quantity in the canals. In Selangor, water shortage still remains a serious problem in practically all areas in Kuala Selangor District, including Panchang Bedena and Tanjong Karang. At Panchang Bedena, rain has revived the yellowing plants in nurseries, but conditions are not yet suitable for planting, the water in the drains being some two feet below soil level. The Beranang River valley area served by the new irrigation system will not be planted this year, as the majority of the cultivators were averse to making a start immediately the irrigation works were

completed and so missed the opportunity of planting. In Negri Sembilan, the position is satisfactory except in Kuala Pilah, where times of planting have been irregular. In Malacca, planting was completed and growth is generally satisfactory. Some water shortage was experienced on areas which lack irrigation facilities. Reports on the crop from Pahang are generally satisfactory, except that water shortage due to low rainfall in Kuala Kuantan delayed planting somewhat in the Sungei Blat area. At the end of the month the position here had improved and was reported to be satisfactory, irrigation water being available in sufficient quantity. Reports from Kelantan are more optimistic than those of the past two months. The weather has favoured ease of cultivation in respect of dry padi and the transplanting of long term wet padi is being carried out with remarkable rapidity.

Rubber.—Prices for small-holders' rubber covered by coupons remain substantially the same as for last month and no very great difference in the prices ruling for coupons or uncouponed rubber is reported from anywhere. During the month, fifteen further smoke cabinets were erected by small-holders, four in Perak, two in East Pahang and nine in Central Johore. Reports again show that the advantage or otherwise to a small-holder of smoking his rubber varies considerably according to circumstances. Thus it is stated that in Province Wellesley the narrow price margin between Standard Sheet and low F.A.Q. makes it unprofitable for small-holders who have erected smoke cabinets to work them, it being advantageous for them to sell unsmoked sheet. Similarly, a smoke cabinet erected at Kuang in Selangor is not in use, as the local dealer refuses to purchase smoked sheet. On the other hand the Agricultural Officer, Johore Central, where nine smoke cabinets were erected during the month, states that the increased price received by small-holders for smoked sheet makes it worth-while for them to smoke all their sheet. This same officer, however, reports that the position in the Bekok area differs, in that there, the narrow margin between grades provides no incentive for the small-holder to effect any improvement in the preparation of his product. The State Agricultural Officer, Pahang, reports that the scheme obtaining in that State, whereby each dealer displays samples of various grades together with the price offered for each, is working smoothly. It is convenient here to record that consideration has been given to the possibility of inaugurating similar schemes elsewhere, but the general opinion is that, although the scheme may be suited to Pahang conditions, it is not suitable for adoption elsewhere.

Coconuts.—The price of copra showed a further slight advance, the highest Penang quotation for sundried being $6.05 per picul. In Province Wellesley and Penang the seasonal decline in crop production has been more marked than usual. One cabinet kiln was erected in Johore Central Circle and five were under construction in the Klang District of Selangor. This renewed activity in the Klang area is the result of the attendance of a number of cultivators at a course of instruction at the Klang Coconut Station which was arranged in connexion with the course in various subjects held annually for Penghulus of the Federated Malay States and Straits Settlements. As only one Penghulu came forward for the copra section of the course, a number of Klang coconut cultivators were got together at

short notice to attend. The Chinese venture at Benut mentioned last month has ended disastrously, for all four kilns erected were burnt down on the 14th September. A further kiln, erected last month in South Perak, was burnt down. In both instances there are reasons to believe that the firing methods advocated by the Department were not followed and, in the case of the Benut kilns, there was also a departure from the dimensions recommended. These instances serve to show the advisability of adhering closely to instructions, both as regards firing and construction. If properly constructed and fired, the danger from fire with the cabinet kilns is very small as has been exemplified at Klang Coconut Station where a number of cabinet kilns of varying sizes have been in use over a long period.

Tuba.—The cultivation of tuba root still continues to extend in Perak South and interest in the crop is well maintained in Johore, whilst tentative enquiries have been made regarding the crop by Malay small-holders in Pahang.

Agricultural Stations and Test Plots.

Agricultural Stations.—The planting of further fruit trees was done at Gajah Mati Station in Kedah and at Bukit Mertajam Station in Province Wellesley. At Selama Station in Perak, some budding of rambutans was done. At this Station two rambutans that fruited are of very poor quality and will be removed. These two trees were planted as marcots obtained from a privately owned fruit orchard which has a reputation for high quality rambutans. Results serve to emphasise the care necessary to make quite certain of the quality of the fruit planted at Agricultural Stations.

Padi Stations and Test Plots.—Scarcity of water through low rainfall has been experienced at Sungei Acheh Test Plot in Province Wellesley, at Titi Serong Station and Briah and Selinsing Test Plots in Krian, at Tanjong Karang and Panchang Bedena Test Plots in Selangor, at Pulau Gadong Station in Malacca and at Kuala Lipis and Sungei Blat Test Plots in Pahang. This has occasioned, in some instances, delayed planting, in others, difficulties with weed growth, and in others, a check to the growing padi. At Kendong Test Plot in Negri Sembilan, marked increased growth is recorded from plots that received a heavy dressing of green manures and also on the plots that last season received heavy dressings of phosphates.

DEPARTMENTAL NOTES.

Visits of the Adviser on Agriculture.

The Acting Adviser visited Kelantan and Trengganu during the period September 21st to 28th for the purpose of advising on agricultural work in progress in those States. On the return journey to Headquarters he inspected Agricultural Stations at Kuala Lipis and Raub, and Padi Test Stations at Kuala Lipis and Dong in Pahang.

Agricultural Leaflets.

The Agricultural Series of free leaflets has recently been extended by the issue of Nos. 11, 12 and 14, on Gambier, Cloves, and Sweet Potato respectively. No. 13, Maize, is at present in preparation, and will shortly be available.

A full list of leaflets and other Departmental publications is printed on the cover of this Journal.

Rural Lecture Caravan.

The Rural Lecture Caravan continued its tour of Pahang during the period 5th to 26th September, eleven centres being visited. In August, eleven centres only were visited and not twenty as mentioned in the September Departmental Notes.

It is estimated that about 16,500 people witnessed the shows throughout the tour of twenty-two centres.

Appointments.

Mr. E. J. H. Berwick, B.A., A.I.C.T.A., Dip. Agric. Sci. (Cantab), has been appointed to be an Agricultural Officer, Department of Agriculture, Straits Settlements and Federated Malay States, with effect from 5th September 1936. Mr. Berwick arrived in Malaya on 1st October, 1936, and assumed duty as Agricultural Officer, Perak Central.

Statistical.

MARKET PRICES.

September, 1936.

Major Crops.

Rubber.—The market continued steady throughout the month, with an upward tendency at the close. Spot loose opened in Singapore at $26\frac{5}{8}$ cents per lb. and closed at 27 1/16 cents. The average price for the month of No. 1 X. Rubber Sheet was 26.65 cents per lb. as compared with 26.59 cents in August. The London average price was 7.68 pence per lb., and the New York price 16.36 cents gold, as compared with 7.58 pence, and 16.17 cents gold in August.

Prices paid for small-holders' rubber at three centres during the month are shewn in the following table.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, September, 1936.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.			Kuala Kangsar, Perak.				Batu Pahat, Johore.				
	3	10	24	2	9	23	30	2	9	16	23	30
Smoked sheet	34.00		33.50	33.91	33.50		33.60		33.50			
Unsmoked sheet	32.50	33.00	33.00		31.20	32.00	32.00	32.20	32.25	32.25	32.40	31.50
Scrap												

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent.

No purchases at Kuala Kangsar on the 16th September, and at Kuala Pilah on the 17th September.

Palm Oil.—The market maintained its improved condition, and prices continued to rise. Quotations for the Malayan commodities are given in Table II.

Table II.
Prices of Palm Oil and Palm Kernels.

Date 1936.	Palm Oil in Bulk, c.i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
September 4	£ 20. 10. 0	£ 11. 0. 0
„ 11	20. 10. 0	11. 0. 0
„ 18	22. 0. 0	11. 5. 0
„ 25	22. 0. 0	11. 10. 0

Copra.—Prices improved slightly in the middle of the month, but weakened at the close. The sun-dried grade opened at $5.55 per picul, and improved to $5.80 on the 15th September, closing at $5.40 per picul. The average price for the month was $5.58 per picul as compared with $5.40 in August. The mixed quality averaged $5 per picul as compared with $4.85 in the previous month.

Copra cake remained unchanged throughout the month at $2 per picul.

Rice.—The average wholesale prices of rice per picul in Singapore in August were as follows:—Siam No. 2 (ordinary) $3.85, Rangoon No. 1 $3.47, Saigon No. 1 $3.57, as compared with $3.62, $3.45 and $3.50 respectively in July. The corresponding prices in August 1935 were $4.05, $3.60 and $3.62.

The average retail market prices in cents per gantang of No. 2 Siam rice in August were: Singapore 26, Penang 30, Malacca 26, as compared with 28, 30 and 26 respectively in July.

The average declared trade value of imports of rice in August was $3.52 per picul, as compared with $3.57 in July, and $3.64 in June.

Padi.—The Krian Government Rice Mill continued to pay $1.90 per picul. Retail prices of padi ranged from 6 to 13 cents per gantang.

Pineapples.—Prices per case continued unchanged throughout the month at: Cubes $3.40, Sliced Flat $3.10, Sliced Tall $3.40.

Prices of fresh fruit per 100 were as follows: Singapore $2.50 to $3.50; Selangor $1.20 to $2; Johore 1st quality $2 to 3, 2nd quality $1.50 to $3, 3rd quality 60 cents to $1.50.

Beverages.

Tea.—Nine consignment of Malayan tea were sold on the London market during September; three consignments were of upland tea, ranging from 1s. 0¼d.

to 1s. $0\frac{3}{4}$d. per lb. The lowland tea ranged from $11\frac{1}{2}$ to 1s. per lb.

Average London prices per lb. during September for consignments of tea from other countries were as follows:—Ceylon 1s. 1.34d., Java 10.98d., Indian Northern 1s. 2.75d., Indian Southern 1s. 0.15d., Sumatra 10.07d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report*, 29th September, 1936, of the Colombo Brokers' Association, and are as follows, in rupee cents per lb.:—High Grown Teas 80 cents, Medium Grown Teas 67 cents, Low Grown Teas 63 cents.

Coffee.—Sourabaya coffee weakened still further in Singapore during September, averaging $12.50 to $13.50 per picul as compared with $12.94 to $13.94 per picul in August. Palembang coffee averaged $6.70 to $8.05 per picul as against $6.80 to $7.70 in August.

Spices.

Arecanuts.—The following are the averages of the ranges of prices per picul in Singapore during September: Splits $4.60 to $6.45; Red Whole $4.40 to $6.50; Sliced $8.90 to 11.20.

The Singapore Chamber of Commerce prices improved still further, average prices per picul being: Best $7.12, Medium $6.80, Mixed $6.05.

Pepper.—Nominal quotations were: Singapore Black $7.25, Singapore White $13, Muntok White $13.50 per picul.

Nutmegs.—Prices fell back again in Singapore during September. Average prices per picul for the month were: 110's $29.25, 80's $29.75, as compared with $29.40 and $29.60 respectively in August.

Mace.—Prices were higher in Singapore, but the market weakened in the second half of the month. Average prices per picul were: Siouw $92.50, Amboina $82.50, as compared with $90 and $75 respectively in August.

Cloves.—Nominal quotations were higher in the second half of the month, being $38 per picul for both Zanzibar and Amboina.

Cardamoms.—Green cardamoms were quoted during September in the Ceylon Chamber of Commerce reports from Rs. 1.40 to Rs. 1.80 per lb.

Miscellaneous.

Derris (Tuba Root).—Continued lack of demand again contributed to a dull and uninteresting market throughout September. The average price per picul for roots sold on a basis of rotenone content remained unchanged at $48, while roots sold on a basis of ether extract fell to $30.

Gambier.—Block and No. 1 Cube were quoted throughout the month at $5 and $10 per picul respectively, as compared with August average prices of $4.80 and $9.80.

Tapioca.—Prices in Singapore continued unchanged with the exception of Seed Pearl which improved slightly at the close of the month. Closing prices per picul were: Flake, Fair $5.50, Seed Pearl $5.75, Medium Pearl $6.50.

Sago.—Prices improved in Singapore, averages for the month being: Pearl, Small Fair \$4.38 and Flour, Sarawak Fair \$2.86 per picul, as compared with \$4.18 and \$2.69 respectively in August.

Tobacco.—Prices in Kedah for locally grown tobacco were: 1st quality \$85 to \$90, 2nd quality \$80, 3rd quality \$64 per picul. Prices in other parts of the Peninsula were as follows: 1st quality \$24 to \$45, 2nd quality \$19 to \$32, 3rd quality \$12 to \$19.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Kohyei & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY*

August, 1936.

Malaya.—Imports of foreign rice during August were 67,825 tons, and exports 17,326 tons, net imports being 50,499 tons. Net imports for the eight months were 356,588 tons as compared with 306,216 tons in 1935.†

Of the imports during August, 49 per cent. were consigned to Singapore, 14 per cent. to Penang, 7 per cent. to Malacca, 23 per cent. to the Federated Malay States, and 7 per cent. to the Unfederated Malay States. The imports by country of origin were as follows:—Siam 69.9 per cent., Burma 28.9 per cent., French Indo-China 0.2 per cent., and other countries 1 per cent.

Of the August exports, 74 per cent. were consigned to the Netherlands Indies and 26 per cent. to other countries. The various kinds of rice exported were as follows (in tons, percentages in brackets): Siam 13,152 (75.9), Burma 2,618 (15.1), French Indo-China 403 (2.3), parboiled 1,098 (6.4), local production 55 (0.3).

India and Burma.—Foreign exports for the period January to July 1936 totalled 873,000 tons, as compared with 1,222,000 tons in 1935, a decrease of 28.6 per cent. Of these exports 3.9 per cent. were to the United Kingdom, 19.3 per cent. to the Continent of Europe, 27.7 per cent. to Ceylon, 19.9 per cent. to the Straits Settlements and the Far East, and 29.2 per cent. to other countries. The corresponding 1935 percentages were 4.6, 11.4, 21.3, 32.4, and 30.3.

Siam.—Exports of rice and rice products from Bangkok during June were 123,472 tons; the cumulative total for the half year was 815,489 tons as compared with 800,625 tons in 1935.

Japan.—Estimated supply and demand from 1st August to 31st October are as follows:—

		Tons
Supply		
Stocks	2,864,000	
Estimated imports	463,000	3,327,000
Demand:		
Estimated exports	14,000	
Estimated consumption	2,048,000	2,062,000
Estimated surplus		1,265,000

According to the *Indian Trade Journal,* 13th August 1936, the area under the first crop in Formosa in 1936 is reported to be 745,000 acres, an increase of about 2 per cent. when compared with 1935. The yield is estimated to be

* Abridged from the Rice Summary for August, 1936, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935.

666,000 tons, which is expected to established a new record, showing an increase of 10 per cent. as compared with the first crop of 1935.

French Indo-China.—Entries of padi into Cholon during the first eight months of the year totalled 1,175,405 tons, a decrease of 9.2 per cent. when compared with the 1935 total of 1,293,996 tons. Exports of rice during the same period totalled 1,230,992 tons, as compared with 1,338,009 tons in 1935, a decrease of 8 per cent.

The Netherlands Indies.—The latest information available was published in the July Summary.

Ceylon.—Imports during the period January to August 1936 were 354,436 tons as compared with 345,422 tons in 1935, an increase of 2.6 per cent. Of these imports 13.4 per cent. were from British India, 62.6 per cent. from Burma, 0.5 per cent. from the Straits Settlements, and 23.5 per cent. from other countries. The 1935 corresponding percentages were: 12.8, 68.9, 1.0 and 17.3.

Europe and America.—Shipments to Europe from the East during the period 1st January to 14th August totalled 824,228 tons, as compared with 558,257 tons in 1935, an increase of 47.6 per cent. Of the 1936 shipments 31.5 per cent. were from Burma, nil from Japan, 59.9 per cent. from Saigon, 7.5 per cent. from Siam, and 1.1 per cent. from Bengal. The corresponding 1935 percentages were 55.1, 4.3, 34.4, 4.3 and 1.9.

Shipments for the Levant from 1st January to 30th July totalled 8,563 tons, as compared with 23,559 tons in 1935, a decrease of 63.7 per cent. Shipments for Cuba, West Indies and America from 1st January to 14th August were 169,657 tons, an increase of 1.8 per cent. over the 1935 shipments of 166,732 tons.

MALAYAN AGRICULTURAL EXPORTS, AUGUST, 1936.

PRODUCT.	Net Exports in Tons				
	Year 1935	Jan.-Aug. 1935	Jan.-Aug. 1936	August 1935	August 1936
Arecanuts ...	21,885	14,281	20,357	363*	3,023
Coconuts, fresh † ...	106,272†	70,244†	78,432†	8,092†	8,297†
Coconut oil ...	35,911	21,260	30,653	3,280	4,123
Copra ...	111,752	70,013	44,617	8,461	12,290
Gambier, all kinds ...	2,837	1,769	1,403	164	115
Oil cakes ...	11,361	5,473	10,415	1,050	1,206
Palm kernels ...	3,892	2,392	2,743	510	378
Palm oil ...	24,996	13,840	17,945	1,764	4,529
Pineapples canned ...	73,923	51,950	60,568	5,911	5,674
Rubber ¶ ...	378,381¶	264,790¶	234,729¶	33,809¶	31,219¶
Sago,—flour ...	10,920	4,747	5,527	572*	2,042
,, —pearl ...	4,655	3,113	2,126	451	252
,, —raw ...	7,735*	4,565*	4,775*	389*	648*
Tapioca,—flake ...	1,953	1,281	1,130	145	128
,, —flour ...	755*	643*	1,328*	29*	159*
,, —pearl ...	17,169	11,511	11,609	1,726	2,279
Tuba root ...	567	397	439	36	34

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION (IN TONS) OF PALM OIL AND KERNELS

(As declared by Estates)

Month 1936	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S
January ...	1,395.4	326.5	258.6	37.2
February ...	1,531.9	372.4	244.2	54.6
March ...	1,878.4	534.5	302.9	88.0
April ...	1,410.6	446.8	250.0	80.0
May ...	1,346.1	644.8	238.1	114.6
June ...	1,557.4	658.3	245.5	100.9
July ...	2,270.5	975.7	349.1	147.6
August ...	2,963.2	1,029.0	419.2	163.0
Total ...	14,353.5	4,988.0	2,307.6	785.9
Total January to August, 1935 ...	10,773.0	3,915.2	1,619.8	574.7
Total for year 1935 ...	17,338.7	5,764.6	2,711.1	818.4

MALAYAN RUBBER STATISTICS

Acreages of Tappable Rubber not Tapped on Estates of 100 Acres and over, for the Month ending 31st August, 1936.

State or Territory	Acreage of Tappable Rubber end 1935	Estates which have entirely ceased tapping		Estates which have partly ceased tapping (a)		Area of Tappable Rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Straits Settlements :—									
Province Wellesley	44,526	400	.9	16,246	36.5	504	1.1	16,646	37.4
Malacca	121,601	4,622	3.8	30,703	25.2	2,776	2.3	35,325	29.0
Penang Island	2,575	675	26.2	568	22.1	283	11.0	1,243	48.3
Singapore Island	34,525	3,929	11.4	9,373	27.1	334	1.0	13,302	38.5
Total S.S. ...	203,227	9,626	4.7	56,890	28.0	3,897	1.9	66,516	32.7
Federated Malay States :—									
Perak	294,988	11,684	4.0	69,809	23.6	14,838	5.0	81,493	27.6
Selangor	332,165	12,087	3.6	67,291	20.3	15,476	4.7	79,378	23.9
Negri Sembilan	258,304	12,955	5.0	53,408	20.7	17,147	6.6	66,363	25.7
Pahang	77,210	9,206	11.9	24,110	31.2	16,686	21.6	33,316	43.1
Total F.M.S. ...	962,667	45,932	4.8	214,618	22.3	64,147	6.7	260,550	27.1
Unfederated Malay States :—									
Johore	432,443	34,171	7.9	58,765	13.6	40,394	9.3	92,936	21.5
Kedah	199,607	22,696	11.4	25,497	12.8	16,182	8.1	48,193	24.2
Kelantan	30,474	403	1.3	10,032	32.9	4,704	15.4	10,435	34.2
Trengganu (b)	4,643	Nil	Nil	Nil	Nil	138	3.0	Nil	Nil
Perlis (c)	1,575	Nil	Nil	689	43.7	64	4.1	689	43.7
Brunei	6,010	Nil	Nil	1,662	27.7	913	15.2	1,662	27.7
Total U.M.S. ...	674,752	57,270	8.5	96,645	14.3	62,395	9.2	153,915	22.8
Total Malaya ...	1,840,646	112,828	6.1	368,153	20.0	130,439	7.1	480,981	26.1

Notes :—(a) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(b) Registered Companies only.
(c) Rendered quarterly.

MALAYAN RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF AUGUST, 1936, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January to Aug. 1936		during the month		January to Aug. 1936						
	Ports	Dealers	Estates of 100 acres and over	during the month	January to Aug. 1936	during the month	January to Aug. 1936	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to Aug. 1936
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	7,701	11,289	11,276	80,015	4,664	41,164	Nil	Nil	Nil	Nil	11,628	4,202	90,661	29,882	...	7,362	11,725	13	73
Johore ...	...	2,594	4,235	4,280	32,449	3,554	24,354	Nil	110	Nil	635	2,486	5,638	17,824	38,819	...	2,658	3,991	...	...
Kedah ...	...	377	2,618	2,674	20,215	792	5,777	Nil	Nil	Nil	Nil	1,509	1,868	11,195	15,278	...	308	2,776	...	...
Perlis ...	...	13	18	11	85	15	155	Nil	Nil	Nil	Nil	Nil	29	Nil	236	...	12	16	...	...
Kelantan ...	...	307	329	324	2,282	583	4,638	Nil	Nil	Nil	Nil	182	765	1,141	5,734	...	266	330	...	...
Trengganu ...	...	55	50	283	1,798	141	899	Nil	Nil	Nil	Nil	Nil	424	Nil	2,697	...	55	50	...	...
Brunei ...	...	19	35	49	343	62	486	...	...	...	...	...	109	...	826	...	11	45	...	...
Total Malay States	...	11,066	18,574	18,897	137,187	9,811	77,473	Nil	110	Nil	635	15,805	13,035	120,821	93,472	...	10,672	18,933	13	73
S. SETTLEMENTS :—																				
Malacca ...	...	1,920	1,188	1,061	7,984	436	4,228	Nil		Nil		2,044		18,778		...	2,474	1,116	...	...
Province Wellesley	...	952	509	456	3,235	223	1,683	Nil		Nil		7,925		58,525		...	933	522	...	...
Penang ...	1,330	5,021	9	13	127	69	633	2,469	11,807	20,622	89,973		Nil		Nil	1,914	3,801	8	...	...
Singapore ...	5,603	17,489	161	125	1,135	111	915	10,803		96,930		17,732		145,453		5,927	16,647	169	30	193
Labuan ...	...	16	Nil	Nil	Nil	17	129	89		567		Nil		Nil		...	22	Nil	...	...
Total Straits Settlements ...	6,933	25,398	1,867	1,655	12,481	856	7,588	13,361	11,807	118,119	89,973	27,701	Nil	222,756	Nil	7,841	23,877	1,815	30	193
Total Malaya ...	6,933	36,464	20,441	20,552	149,668	10,667	85,061	13,361	11,917	118,119	90,608	43,506	13,035	341,577	93,472	7,841	34,549	20,748	43	266

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	6,319	15,782	3,449	2,950	2,006	162
WET RUBBER	1,043	865	352	490	652	146
TOTAL ...	7,362	16,647	3,801	3,440	2,658	308

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to Aug. 1936
29	30	31
Singapore ...	26,159	216,301
Penang ...	11,541	84,629
Port Swettenham.	5,529	39,671
Malacca ...	277	2,976
MALAYA ...	43,506	343,577

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to Aug. 1936
32	33	34
Malay States ...	28,840	214,293
Straits Settlements	2,570	19,212
MALAYA ...	31,410	233,505

Notes :—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23rd September, 1936.

METEOROLOGICAL SUMMARY, MALAYA, AUGUST, 1936.

Locality.	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B.	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total	Total	Most in a day. Amt.	Number of days: Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total.	Daily Mean.	Per cent.
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	91.2	71.6	81.4	98	69	86	74	83.7	84.6	4.06	103.1	1.53	14	12	1	1	1	188.30	6.07	49
Bukit Jeram, Selangor ...	88.3	72.3	80.3	92	69	83	75	84.0	86.2	5.66	143.8	2.16	10	8			2	217.10	7.00	57
Sitiawan, Perak ...	88.8	73.2	81.0	91	71	81	75	84.1	84.7	2.38	60.5	0.78	8	7				220.25	7.10	58
Temerloh, Pahang ...	89.0	71.6	80.3	93	67	85	74	85.3	86.0	4.52	114.8	1.14	17	14	8	5		194.10	6.26	51
Kuala Lipis, Pahang ...	89.6	71.0	80.3	93	69	84	74	83.9	84.9	3.88	98.6	1.37	14	10	6	18		178.95	5.77	47
Kuala Pahang, Pahang ...	87.0	73.8	80.4	91	72	84	77	85.4	86.6	6.24	158.5	2.44	11	10			2	21[illegible].90	6.83	56
Kallang Aerodrome, S'pore ...	85.5	75.8	80.7	89	73	80	81	82.6	84.1	4.48	113.8	1.01	23	17	1			177.60	5.73	47
Butterworth, Province Wellesley ...	87.0	73.9	80.5	90	72	79	76	84.4	85.3	7.95	201.9	1.38	19	16	1		1	190.60	6.15	50
Bayan Lepas Aerodrome Penang ...	86.7	74.1	80.4	89	72	81	76	83.5	84.3	10.42	264.7	2.63	20	16	1	1		178.60	5.76	47
Bukit China, Malacca ...	84.7	73.2	78.9	87	70	82	76	82.5	83.6	13.96	354.6	2.75	21	17	4		2	180.40	5.82	48
Kluang, Johore ...	87.8	70.9	79.3	91	69	84	74	81.6	82.4	6.71	170.4	1.20	17	15	4	3	1	164.75	5.31	43
Bukit Lalang, Mersing, Johore	86.6	71.5	79.1	89	69	83	74	81.8	81.9	7.47	189.7	1.40	18	16	2	1	4	173.70	5.60	46
Alor Star, Kedah ...	87.2	74.1	80.7	90	72	82	77	85.5	86.2	11.01	279.7	1.08	19	17				168.05	5.60	45
Kota Bahru, Kelantan ...	89.2	73.0	81.1	92	71	85	76	84.3	84.8	8.30	210.8	1.36	22	21	7	1	6	209.60	6.76	55
Kuala Trengganu, Trengganu	87.9	72.0	79.9	90	70	84	74	83.1	84.6	10.09	256.3	1.64	19	15	6	1	2	199.80	6.45	52
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	74.2	62.1	68.1	79	59	70	64	71.3	72.3	10.39	263.9	1.35	19	18		10	1	164.85	5.32	44
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.2	56.9	64.5	77	50	68	62	70.4	70.1	7.68	195.1	0.99	22	20	2	1	1	151.90	4.90	40
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.4	59.4	65.4	76	58	66	61			7.41	188.2	1.08	21	19	2	1	1	157.70	5.09	41

Compiled from Returns supplied by the Meteorological Branch, Malaya

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AGRICULTURAL SERIES.

DEPARTMENT OF AGRICULTURE, S.S. & F.M.S.

Agricultural Leaflet No. 13.

MAIZE

(ZEA MAYS)

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October, 1936.

MAIZE

(Zea Mays)

Description.—Maize or Indian corn (jagong, Malay) is an American cereal grown to a limited extent in Malaya. Its cultivation is intermittent and generally confined to small areas of land. This crop, however, grows and yields well in this country, provided a fertile soil is selected.

A single erect stem is ordinarily produced but basal shoots often occur, especially when the plants are widely spaced. When the crop is grown for its grain, their presence is undesirable, as improperly developed cobs do not counterbalance the extra drain on plant nutrients and moisture from the soil.

The maize plant is wind-pollinated and, as the male and female flowers open separately, is usually cross-pollinated. The probability of cross-pollination between varieties is, therefore, evident; in fact unless varieties are planted a considerable distance apart, or the female flowers are "bagged" when the silk is receptive, the resulting seedlings will be of mixed parentage. Such seedlings are stated to be very vigorous and produce heavy crops as a result of hybrid vigour.

The flowering period occurs approximately half-way between germination and maturity.

The size of the cob (tongkol, Malay), number of rows of grain, and the colour and shape of the grains themselves, vary greatly according to variety. Hickory King (white dent) has normally eight rows of grain. The local yellow flint commonly has fourteen rows. Odd numbers of rows rarely occur.

Varieties.—Although the genus *Zea* contains but a single known species, maize, in common with the majority of the older cultivated crops, displays many diversities of form. Ten or so sub-species have been described. Only three are normally grown in Malaya and require notice.

1. var. *indurata,* the "flint" varieties. The grain is composed of horny endosperm completely surrounding the starchy endosperm. Flint grain is harder and usually smaller than dent.
2. var. *indentata,* the "dent" varieties. The starchy endosperm reaches the surface of the grain at the apex, producing a marked indentation.
3. var. *rugosa,* the "sweet" varieties. The grain upon ripening shrinks and assumes a crinkled, translucent, horny appearance. The cobs are solely used green as a vegetable.

The number of varieties cultivated is very great, especially of the dent breed. White dents introduced and grown successfully in Malaya include Hickory King, Natal White Horsetooth, Potchefstroom Pearl, Salisbury White. Chester County, a yellow dent, has also been grown. Good flint samples are met with locally and are more commonly grown than the introduced dent varieties. Seed of the sweet breed is imported from time to time for use in the vegetable garden.

Uses.—Owing to the rice eating habit of the people of Malaya, there is no great demand locally for maize. The cobs are usually consumed in an immature stage, either boiled or steamed. In Africa, the young cobs are roasted and served whole. Cobs, if picked when quite tender, *i.e.* about fifteen days after the silk has shrivelled, form an excellent vegetable and should be grown to a greater extent than at present. All varieties may be employed for this purpose but the sweet breeds are generally considered the best. In Java, this food crop is of greater importance than in Malaya, and the grain is ground into flour for use in the preparation of cakes and porridge. In the same country, the dried sheaths surrounding the cobs are used as wrappers for cigarettes.

The maize plant is unlikely to be used to any great extent as a fodder plant in Malaya, owing to the heavy crops produced from fodder grasses that require less cultural attention and are productive for a longer period. In many countries, maize has a high reputation as a fodder crop and when grown solely for this purpose, is harvested when both cobs and foliage are palatable to stock.

The local flint breed with small grain is used for feeding poultry. Supplies are inadequate and grain is imported from India and elsewhere and sold at about $4.50 (Straits currency) per picul (133 1/3 lbs.) Difficulty is often experienced in obtaining supplies.

Soil Requirements and Selection of Land.—The maize plant is surface rooting and, as it matures, adventitious roots emerge from the lower nodes and grow towards the soil. These roots assist in anchoring the plant which often becomes topheavy when the cobs swell. A study of the root system suggests that the maize plant, under natural conditions, grows on low-lying land adjoining rivers, and subject to flooding. Under such conditions the brace roots readily penetrate the moist soil and thus serve a dual purpose. It is also evident that where the soil is inclined to be compact, thorough cultivation before sowing is necessary.

The Malays commonly grow maize on land adjoining rivers that has been cleared of secondary growth and burnt off during dry weather. One or more crops are grown on this land before

the soil becomes exhausted and insufficiently fertile to produce further crops.

Maize makes a large drain upon the supply of phosphoric acid in the soil, and for this reason is frequently used as an indicator plant when information of the relative amount of this nutrient is required.

On virgin land, not subject to surface erosion, one or more crops may be obtained. Subsequently, unless heavy manuring is resorted to, growth of the plants and crop show rapid deterioration.

Heavy coastal clays, after thorough cultivation, have yielded satisfactory crops.

Owing to the fact that the maize plant obtains its food supply from a shallow layer of the surface soil, it is necessary to conserve fertility in this layer to obtain a satisfactory crop. Knowledge of this subject is at present meagre, but some form of soil recuperation is evidently necessary. It is known that fertility is regained when land is rested under natural growth of low shrubs and trees for a number of years. This system has obvious limitations, and whether similar results may be obtained through the employment of leguminous shrubs in rotation with periodic cropping, is a matter for further observation.

Manurial experiments conducted with this crop have shown that basic fertilizers are most likely to give satisfactory results because it is especially sensitive to acidity. Calcium cyanamide and basic slag at the rate of about 2 cwts. of each fertilizer together with half a cwt. of sulphate of potash per acre is recommended. The fertilizers should be applied to the land a week or more before sowing. It is not generally possible to obtain cattle manure in quantity; therefore, in the majority of instances, its use over an extended area is ruled out. At the Central Experiment Station, Serdang, on an infertile valley quartzite soil, no response was obtained from artificial fertilizers and it was necessary to apply cattle manure up to 20 tons per acre together with half a ton of lime per acre to obtain satisfactory yields.

Planting Seasons.—Maize under local conditions usually matures within three to three and a half months. Sowing should, therefore, be done at the commencement of the rains which occur normally in late October and early April. It is important that the crop should mature during dry weather, in order to secure good quality grain and obviate damage to the standing crop from heavy rainstorms.

Preparation of Land and Planting.—Deep cultivation is necessary in order that the plants may not receive any check during dry weather. The land should be either ploughed or dug

to a depth of eight inches and any green material growing on the area turned below the soil. The surface is brought to a fine tilth, either by harrowing or hand labour.

On a reasonably light soil, a pair of bullocks, a small plough, and two labourers, can plough an acre in two and a half days, and harrow a similar area twice in one day. Heavy soils will take longer and it may be found difficult to secure a good surface tilth. Allowing $2 per day (Straits currency) for upkeep of bullocks and 85 cents per day for two attendants, together with five labourers working days for digging corners, collecting and burning rubbish accumulated by the harrow, the cost of preparing the seed bed will be about $12 per acre. If hand labour is employed entirely in preparing the land, the cost is approximately $18 per acre.

When a fine deep seed bed is obtained, the grain is sown in rows 2 to 2½ feet apart and spaced 15 to 18 inches apart in the rows. The flint varieties are generally less robust and require less space than the dent breeds. Closer spacing, however, is inadvisable, the object being to secure as many plants as possible to the acre without one encroaching upon another. When growing the crop for fodder, the closer spacing is adopted. From 15 to 18 lbs. of seed of the dent varieties are required to sow an acre, whereas 10 to 12 lbs. are sufficient in the case of the flint breeds. If the seeds are not fresh and liable to give irregular germination, two or more seeds per hole should be sown, with a corresponding increase in the planting rate.

The seeds should be planted at least two inches deep, and covered with soil in order to prevent birds from stealing the grain. At Serdang, the Malay Spotted Dove, *Streptopelia chinensis tigrina*, is the worst offender, and causes appreciable damage. Germination commences in five days from sowing and is usually completed within a further week.

The cost of sowing seed by hand varies according to the condition of the land, but should not exceed $3 per acre.

Cultivation.—Light surface cultivation should be undertaken periodically in order to suppress weeds and retain moisture in the soil by means of a surface mulch. Deep cultivation with the standing crop is deleterious, as damage may result to the surface roots of the plants. In advanced maize-growing countries, mechanical tillage and cultivation are employed extensively, since it is recognized that the maize plant requires a higher standard of cultivation than other staple grain crops. As the plants produce adventitious roots, surface soil between the rows may be drawn up towards the plants in the form of a ridge. The cost

of these operations by hand labour should not exceed $10 per acre.

Harvesting.—Since the weight of grain increases up to complete maturity, and well-dried grain reduces attacks of insect pests, the cobs should be allowed to become quite dry before harvesting. By this means the maximum crop is secured in good condition for storing. The cost of harvesting and cleaning the mature cobs by hand varies according to crop, but is in the neighbourhood of $5 per acre.

When grown on a small scale for home consumption, it is customary to pluck the immature cobs as required.

Yields.—Trials at the Central Experiment Station, Serdang, over a number of years have shown yields to be very variable according to soil conditions. Under optimum conditions a yield of 2,500 lbs. dry cobs per acre may be obtained, yielding 2,000 lbs. grain upon shelling. The dent breeds are the highest yielders. The proportion of grain to cob by weight varies from 78 to 83 per cent. under ordinary circumstances, but may be higher when the butt is thoroughly dry. The following figures were obtained from a typical sample of local flint maize in husk. Number of cobs examined, 360; weight, 100 lbs., weight of husk, 14 lbs., weight of butts, 14 lbs., weight of grain, 72 lbs. The number of seeds per lb. varies from 1,200 to 2,000 according to variety and quality of sample. The first figure represents a large dent variety *e.g.* Hickory King, and the latter an imported small flint grain. A fair sample of local flint averages 1,600 grains per lb.

A yield ranging from 15 to 20 tons of fodder is obtained, depending upon the type of maize grown and soil conditions. It appears advantageous to cut the crop for stock feeding when the lower leaves are just beginning to turn brown. At this stage the cobs, although formed, are still soft and the husk green. The proportions of the component parts ascertained by the Chemical Division are then roughly as follows:— leaves 20 per cent.; stems, 40 per cent.; cobs, 40 per cent. Maize forms, in this condition, a succulent and palatable food with a high proportion of carbohydrates, amounting to 15 per cent. calculated upon the weight of the freshly cut fodder. Owing to a comparatively low crude protein content (2 per cent. calculated on a similar basis) admixture with fodder grasses such as Guinea grass is advisable, in order to increase the crude protein content of the ration.

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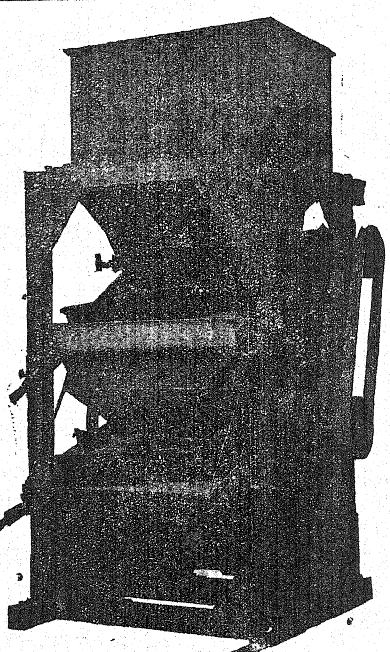

THE

Malayan Agricultural Journal.

NOVEMBER, 1936.

EDITORIAL.

Irrigation of Riverine Areas.

It is natural to assume that areas situated in the vicinity of a large river where soil conditions are suitable for padi growing, would be ideal for cultivation of this crop, as it would be expected that irrigation would present no difficulties. Such is not invariably the case, however, as is exemplified by many areas situated along the reaches of the Perak River.

On the areas in mind, padi has been grown for a great many years, and it is probable that cultivation of the crop was carried on under satisfactory conditions at some time in the past, but that changes in the depth of the river bed, and in its course, have changed conditions. The present position is, that irrigation of the crop by gravitation presents considerable difficulties, as the banks of the river are high and water in the river for parts of the year is at a lower level than the padi land, and no small streams are situated conveniently to allow of their being used for irrigation. For many years past, the cultivation of padi on such areas has been a very precarious occupation. The land is often too dry to allow of nurseries being sown and seedlings transplanted in the months of July and August, the usual time for padi planting, generally, in the part of the country concerned. Consequently, it has been impossible in most seasons to have the crop sufficiently well grown to withstand the flooding which nearly always occurs to a greater or lesser extent during the months of November and December.

In the present issue we have pleasure in reproducing a short, but informative article by Mr. A. G. Robinson, Adviser, Drainage and Irrigation, Malay States, in which the writer describes the putting into operation of a scheme, launched towards the end of 1933, of irrigating padi areas, both actual and potential, in the mukims of Bota and Lambor Kanan, lying along the Perak River. At the time when this enterprise was undertaken, there were two thousand acres of cultivated land, and five hundred acres of land in that area that could be brought under cultivation; there are now also prospects of bringing still more areas in the vicinity under cultivation.

It is hoped that this present scheme will show the way to the elucidation of the problem of irrigating other areas suitable for padi cultivation which lie near rivers, but which, up to now, have to rely on rainfall for their water.

The writer of the article points out that the scheme was intended to assist and to improve the somewhat precarious living conditions of the peasants domiciled in the area. Efforts to achieve this object alone would be worth while, even if the scheme failed to be successful from an economic point of view.

Poultry Feeding. In the feeding of poultry, and of course, other domestic stock, so that the best possible results may be obtained, it is highly important that special attention be given to the constituents of the food provided, since it is recognized that an excess of an individual item can as easily nullify careful planting as can a deficiency.

We publish in this number an account of the next step in the investigations on the feeding of poultry, which have been conducted at the School of Agriculture, Malaya, Serdang. In the previous article on this subject which appeared this year in the May issue of this Journal, attention was drawn to the importance of correct feeding when it is desired to raise pure bred fowls under intensive or semi-intensive conditions, and the results of tests in which standard rations were given to young chicks were recorded.

It is scarcely necessary to point out that to terminate such investigations at that stage would be very unsatisfactory. This being so, an extension of the work was embarked upon, this time to embrace investigations into the feeding of growing chicks.

In the article which we print in the present number the results of these investigations obtained with three groups of Rhode Island and one group of Light Sussex are set forth in tabular form, and the proportions of the constituents of the food mixture used are given. This mixture is considered by the writer of the article to be satisfactory, both from the point of view of its efficiency in promoting the growth of the chicks, and of its comparatively low cost.

Rural Lecture Caravan. More than five years have elapsed since the inauguration of the scheme for spreading agricultural knowledge among the peasantry by means of lectures and demonstrations, through the medium of a caravan of a type fit to travel on all primary and secondary roads. The first description of this caravan, compiled by officers of the Co-operative Societies Department and of the Department of Agriculture, S.S. and F.M.S., appeared in this Journal in May 1931.

Taking into consideration the comparatively long period during which the caravan has been operating, we are now convinced that a useful purpose would be served in summarizing the work accomplished, the difficulties encountered and other facts—particularly those connected with capital costs of the caravan and equipment, running costs, and the methods by which knowledge of up-to-date agricultural practice is imparted to rural populations—which would undoubtedly be of service to Agricultural Departments in other countries not yet possessing, but desiring, adequate facilities for disseminating propaganda among the peasantry.

In the article which we reproduce in this number, full information in respect of these details is supplied.

It is highly satisfactory to note that definite results of far-reaching importance have been achieved during the five years of active service of the Caravan. These results are reflected in the general improvement in agricultural products and in the amelioration of living conditions in villages, due to the increase in membership of the General Purposes Co-operative Societies, as a result of lectures delivered by officers associated with this scheme.

The Germination of Padi. Among the peasantry of Malaya there exist many beliefs in relation to procedure in padi cultivation. One of these beliefs concerns the age of padi which is intended for sowing purposes. According to this particular belief, if satisfactory germination is to be expected, padi should be at least 100 days old at the time of sowing.

We include a short article by Mr. C. H. Burgess, Agricultural Officer, Krian, in which the author describes experiments designed to throw light on this belief.

Original Articles.

IRRIGATION OF RIVERINE AREAS

Bota-Lambor Kanan Pumping Scheme, Perak River

BY

A. G. Robinson, B.Sc. (Eng.), M. Inst. C.E.,
Adviser, Drainage and Irrigation, Malay States.

As long ago as 1912 a proposal was made to pump water to irrigate bendangs* on the left bank of the Perak River between Layang-Layang and the southern boundary of Kuala Kangsar District.

Successive District Officers tried to revive interest in the proposal, but much of the potential padi area intended for irrigation became planted with rubber.

Towards the close of 1931 when the new Department of Drainage and Irrigation was about to be formed, the District Officer, Kuala Kangsar, drew the attention of Government to the question of irrigation of bendangs along the Perak River below Parit, pointing out that the matter seemed to have died away more or less abortively. He stated that, as a result of his visit to the mukims of Bota, Layang-Layang and Lambor, he was greatly impressed by the great disadvantages which the large existent bendang areas suffered from, owing to absolute lack of water. The four densely populated mukims lying below Parit in this district, he added, depended entirely for their harvest on the rain which they may or may not get. The areas, in good seasons, are heavy-producing and, as irrigation on a grand scale from the Perak River seemed remote, he suggested small pumping schemes so that the risk of total failure of crops, and consequent widespread distress, such as was presaged that year as the result of drought, would be rendered comparatively remote.

The immediate problem was to supply irrigation to the present cultivated area of 2,000 acres and to 500 acres of adjoining uncultivated padi land. It would be necessary to pump the irrigation supply from the Perak River and to deliver it in an open earthen canal for a distance of no less than eleven miles to irrigate the bendangs interspersed between well populated kampongs along the bank of the Perak River.

In order to bring the scheme within the realms of practical economics, it was designed so that irrigation would be by rotation. Half of the area, let us say Bota Mukim, would receive full irrigation from July to September. Planting in the other half, or Lambor Mukim, would be delayed until October. Both areas would receive half supply during the wet season, October to December. An eight months padi would be planted which would be harvested in Bota Mukim

* bendang = a more or less definitely defined area of flat low-lying land suitable for padi cultivation.

during the dry month of February when the Lambor area would be receiving full supply, and the crop on the latter area would be harvested in the dry month of June. The size of the pumping plant was thereby reduced by half. Even so the estimated cost of the scheme was \$30,000, and a water rate of not less than \$3 per acre would be required to meet interest on capital, depreciation of machinery, and the annual cost of running the plant.

In recommending the scheme for the consideration of Government it was pointed out that the capital cost was less than the value of the annual crop which the scheme would save in times of drought.

The considered view of the Perak State Drainage and Irrigation Board was:—

> "................that this work should be regarded as an experiment, the results of which, if successful, will be of great value generally for all areas, not only in Perak but elsewhere in the Federated Malay States, which have a similar problem of padi lands near large rivers dependent on the vagaries of rainfall for the success of the crop. A sum of \$30,000 need not be considered an excessive amount to pay for such an experiment, and it is not considered that Government should seek to recover the cost of the experiment or any part of it until it has been proved successful.
>
> "Secondly, it is not considered probable that it will ever prove feasible to impose so high a rate as \$3 per acre. In other words, the expenditure on this particular scheme cannot be regarded as likely to be a good economic proposition. Its justification must rest on other grounds, connected with the general welfare and advancement of the rural population. The scheme is calculated to rescue from penury a population of Perak Malays who live very precarious lives, more especially since the slump in rubber: it is in fact a relief work of a permanent nature and of the right kind, in that it will increase the local production of padi.
>
> "The beneficiaries should certainly contribute, by means of a drainage rate, towards the cost of the work, to the utmost which they can reasonably pay; but the time of imposition and the incidence of this taxation must be left to local discretion."

It was therefore on these political rather than economic grounds that Government approved the scheme.

The scheme was launched at the end of 1933. The best available site for an intake on the Perak River was selected and the lines of the tali ayer* which had been surveyed in the previous year were set out and construction of the canal on contract with the local inhabitants was commenced.

The pumping plant consists of a 68 h.p. Allen Diesel engine coupled to a Gill axial flow pump capable of delivering 25 cubic feet of water per second, equal to nearly twice the water supply of Kuala Lumpur town.

Water is drawn from the Perak River through a 20 in. diameter cast iron pipe accurately aligned on steel channels embedded in concrete laid up the slope of the bank at an angle of 45 degrees. The pump of the helix or screw blade type is housed in the submerged end of the pipe and the pump shaft is fixed along the centre line of the pipe by brackets designed to offer the least resistance to flow in the pipe.

---

* tali ayer = irrigation channel.

The engine and air compressor for starting the engine, and also the bevel gear drive to the pump shaft, are housed in a corrugated iron shed on the bank of the river. The engine and bevel gear encasement are mounted on a concrete plinth sufficiently high to prevent the cylinders being flooded except in the event of an extraordinarily high flood.

On reaching the top of the bank the rising main is forked, one leg of the fork containing the pump shaft extension to the bevel gearing, and the other leg connecting up with the horizontal 20 in. diameter delivery pipe which passes under the engine plinth and discharges into a concrete intake at the head of the irrigation canal.

Cooling water is supplied by a set of four water circulating tanks in addition to a direct supply when necessary from the rising main to the engine water jacket which is brought into use only for short periods of the daily run on account of the turbidity of the water.

Close driven sheet piling of 3 in. timber with suitable timber guide piles and runners are used to revet the sides of the steep bank leading to deep water in the river, and a wrought iron screen is provided to prevent débris entering the pipe and clogging the impeller.

Last year was the first year of operation, and considerable care and attention were given to the working of the scheme by the Agricultural Officer, Perak Central, and the Drainage and Irrigation Engineer working in close co-operation.

The views of the Drainage and Irrigation Department on the working of the scheme are given in the Annual Report of the Department for 1935, as follows:—

> "Pumping was commenced in July and the pump was kept running practically continuously until 19th December. A lavish supply of water was given and the prospective crop is greatly in excess of anything formerly obtained.
>
> "The quantity of water pumped was 231,467,800 cubic feet and from the beginning no shortage of water was experienced.
>
> "The year 1935 must be regarded as experimental from every point of view. The amount of water pumped was greatly in excess of that which should have been required; this was largely because, though the ryots were told to prepare their lands early as water would be available in the month of June, practically no preparation was made.
>
> "The arrival of water expelled former doubts in the minds of the cultivators and gave them confidence in the works but planting was late and occupied a long period.
>
> "The scheme is unique in that the pumped water is delivered into a canal 11 miles long to irrigate some sixteen areas of padi interspersed between kampongs. These areas vary in size from 400 acres to less than 20 acres and comprise in all some 2,000 acres already in cultivation and 500 acres of potential padi land.
>
> "During the planting season several visits were paid by the Drainage and Irrigation Engineer and the Agricultural Field Officer to examine the

functioning of the scheme. Most of the areas were found to be well cultivated and well supplied with water; in others, there was excess of water owing to defective drainage and in some there was a shortage of water due to a sandy sub-soil.

"With the abundant rainfall of October and November, little or no pumping should have been required but it was not possible to stop the pump at all because the water requirements of no two bendangs were alike.

"These are details which will require the closest co-operation of the two departments of Irrigation and Agriculture for the improvement of the irrigation service by meeting as far as possible the requirements of the cultivators while getting them to co-operate in every way.

"The season's crops are said to be very promising and by far the best ever grown in these mukims, and its efficient management will have to be built up year by year by close observation and by instituting a number of measures for the conservancy of water in some areas and improved drainage in others."

The Agricultural Officer has reported as follows:—

"It is satisfactory to report that apart from one or two instances, no major difficulties have been experienced and considering that this is the first planting season under the new scheme conditions may be stated to be satisfactory. The main tali ayer has settled well and no serious breaches have occurred. Seepage through the banks has also lessened as the earthwork has set, and water conditions in small rubber holdings adjacent to the tali ayer have improved. This point is being carefully watched from the drainage point of view and any outbreaks of root diseases in the rubber holdings.

"The main problems as regards the bendangs seem to be localised levelling and the construction of cross batas by the ryots and in some cases drainage. It may be noted here that drainage problems in the Bota area are not expected to be so bad as those in the Lambor area. There is a natural slope from Bota towards Lambor and consequently the main drainage problems will be connected with the latter area.

"Planting dates will cause some difficulty as some ryots plant earlier than others and consequently want water when other later planters want their bendangs dry. It will be necessary for Penghulus and Ketua Kampongs to divide the bendangs into areas which must all be planted at the same time. In this way water control will be more efficient and there will be fewer disputes as to who wants water and who does not. A large area is difficult to irrigate when split up amongst so many cultivators and the difficulties are only increased when they carry out planting in a haphazard manner."

In December 1935, the area was visited by Dr. Tempany, late Adviser on Agriculture, Malay States. He was greatly impressed by the excellent growth made and was told it was by far the best crop ever grown in that area.

Irrigation by rotation has so far not been tried. Last season's crop was late planted, and the whole area received irrigation at the same time, and, therefore, at half duty, the duty of water in this scheme being considered to be 100 acres to the cusec* during dry weather.

The present view of the State Drainage & Irrigation Board, is that the season for Lambor Mukim should be fixed for January-July and in Bota Mukim July-January, the objection to October planting being the probability of flooding from the Perak River destroying the young seedlings. An experiment with a January-July crop is now in progress by the Agricultural Department on a 20 acre plot which is receiving full irrigation from the pumping plant.

Another pumping scheme immediately downstream of the Lambor area is under construction in Pulau Tiga Mukim on the Lower Perak side of the District boundary, to serve an area of about 3,000 acres.

As will have been noted, these schemes have a greater significance than their immediate object of irrigating areas where conditions have been so precarious. Furthermore, to the east of these areas there is a vast swamp along the right banks of the Tumboh and Kinta Rivers, some of which in times past has been cultivated; but for many years now owing to silting of the Tumboh and Kinta Rivers it has lain waste and kampongs have become desolate. There are probably some 30,000 acres available in the triangle between the three rivers, and if brought into cultivation, irrigation would be practicable by a deep canal off-take from the Perak River, and without the necessity for an expensive barrage, the whole of this area, excepting the Bota area, would be commanded by the water level that would be available in the canal at low water stage in the Perak River.

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* "Cusecs" is an abbreviation for cubic feet per second.

A RATION FOR GROWING CHICKS

BY

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Introduction.

In a previous article (1), the author drew attention to the importance of correct feeding when raising pure-bred fowls under intensive or semi-intensive conditions, and advocated for young chicks a dry mash containing a liberal proportion of biologically good proteins, in the form of dried skim milk, balanced by carbohydrates, fats, minerals and vitamins. As a logical extension of that work, investigations have been carried out at the School of Agriculture, Serdang, on the feeding of growing chicks, *i.e.* young fowls from the age of 12 weeks (when weaning from chick mash is complete) until they are about to come into lay or are disposed of as table birds.

Good feeding is just as important with growers as with young chicks, but fewer biological and economic difficulties appear to be involved. Thus, general experience indicates that growers do not require more than about 12 per cent. digestible protein in the ration, and that they can make satisfactory use of various concentrates such as whale meat and groundnut or soya-bean cake which are of inferior biological value when fed to young chicks. Suitable growers rations are therefore less expensive, weight for weight, than chick rations.

According to Halnan (2), the energy requirements of balanced poultry mashes are about the same (60 to 65 per cent. of starch equivalent) for young chicks, growers and layers, the increasing demand for energy as body weight increases being met by a larger intake of food. As with young chicks, however, proteins and energy require to be suitably balanced by minerals and vitamins.

Growers Mash.

With the above considerations in mind, the following mash was evolved and has been tested at the School on various groups of growing chickens, mainly pure-bred Rhode Island Reds.

Growers Mash.
(Parts by weight)

Padi, ground, husk discarded	...	38 parts
Maize, yellow, ground	...	20 ,,
Bran, white cargo	...	20 ,,
Whale meat meal	...	10 ,,
Groundnut cake	...	10 ,,
Steamed bone flour	...	2 ,,

Powdered limestone	...	1 part
Salt	...	1 ,,
Red palm oil	...	3 parts
		100 ,,

(supplying about 12.3 per cent. digestible protein and 63.5 per cent. starch equivalent).

For purposes of comparison, average weights cited by Card and Henderson (3) were employed and are given in Table I. These weights cover the period from 14 to 22 weeks of age and apply only to pullets. Corresponding figures for cockerels are not available, but they would normally be somewhat higher. So far it has not been possible to attain these average weights with Rhode Island pullets raised at the School, and, for this reason, increases in weight have been converted into percentages to enable a fair comparison to be made.

Table I.
Average Weights of R.I.R. Pullets in U.S.A.

Age	Average weight	Percentage increase during past 14 days	Percentage increase over weight at 14 weeks
14 weeks	41.1 ozs.	—	—
16 ,,	46.6 ,,	13.4	13.4
18 ,,	52.2 ,,	12.0	27.0
20 ,,	58.9 ,,	12.8	43.3
22 ,,	64.6 ,,	9.7	57.2

The birds were accommodated in small grassed runs and housed in portable night-arks. Growers mash was fed from the 12th to the 18th week, after which layers mash was gradually introduced, the change-over being completed by the end of the 21st week*. The mash was fed dry and *ad lib.* from 7 a.m. to 6 p.m. daily, with fresh greenstuff each afternoon. In addition, a small quantity of whole grain (padi) was given from the 12th week onwards, beginning with a few grains scattered over the mash and leading to a separate evening feed which was gradually increased to 1½ ozs. per head by the 22nd week. The birds had constant access

* Rhode Island and Light Sussex pullets raised at the School usually come into lay at about 6 months of age — a month or so earlier than is usual in Europe and America. This sexual precocity is probably due to climatic and hereditary factors rather than to feeding. So long as pullets are up to breed weight, early sexual maturity is an advantage. But it should be discouraged in fowls which are under weight for their age, and the desirability of introducing layers mash at a somewhat later stage will be investigated when opportunity presents itself. (G.E.M.)

Table II.

Growth Rate of Heavy Breed Pullets at Serdang.

Age	Card & Henderson's Figures			R.I.R. Group 48 (16 pullets)			R.I.R. Group 50 (7 pullets)			R.I.R. Group 52 (6 pullets)			L. S. Group 49 (8 pullets)		
	Average Weight	Percentage Increase in past 14 days	Percentage Increase over Weight at 14 weeks	Average Weight	Percentage Increase in past 14 days	Percentage Increase over Weight at 14 weeks	Average Weight	Percentage Increase in past 14 days	Percentage Increase over Weight at 14 weeks	Average Weight	Percentage Increase in past 14 days	Percentage Increase over Weight at 14 weeks	Average Weight	Percentage Increase in past 14 days	Percentage Increase over Weight at 14 weeks
14 weeks	41.1 ozs.	—	—	34.9 ozs.	—	—	34.0 ozs.	—	—	29.0 ozs.	—	—	39.5 ozs.	—	—
16 ,,	46.6 ,,	13.4	13.4	40.0 ,,	14.6	14.6	41.0 ,,	20.6	20.6	33.0 ,,	13.8	13.8	46.4 ,,	17.5	17.5
18 ,,	52.2 ,,	12.0	27.0	45.5 ,,	13.7	30.4	47.0 ,,	14.6	38.2	38.8 ,,	17.6	33.8	53.2 ,,	14.7	34.7
20 ,,	58.9 ,,	12.8	43.3	51.6 ,,	13.4	47.8	50.4 ,,	7.2	48.2	45.6 ,,	17.5	57.2	60.0 ,,	12.8	52.2
22 ,,	64.6 ,,	9.7	57.2	56.6 ,,	9.7	62.2	58.7 ,,	16.4	72.6	53.0 ,,	16.2	82.8	67.4 ,,	12.3	70.6

to coarse sand and crushed limestone. The layers mash contains the same ingredients as the growers mash, but the protein concentrates are increased at the expense of ground padi in order to provide the additional food material required for egg production.

Results.

The results obtained with three groups of Rhode Island and one group of Light Sussex pullets are given in Table II. For investigations of this nature, Light Sussex are reasonably comparable with Rhode Islands as both rank as heavy breeds.

It will be seen that the average increase in 8 weeks varied from 62.2 to 82.8 per cent. of the average weights at 14 weeks of age, all groups exceeding Card and Henderson's figure of 57.2 per cent., and that on only one occasion did the fortnightly increase fail to reach the adopted standard.

It would thus appear that, for purposes of growth, the ration described herein is satisfactory.

Excluding transport charges from local dealers and the cost of grinding and mixing, the cost of the growers mash at the School is about 2½ cents per lb. This also is considered satisfactory.

Literature Cited.

(1) The Food Requirements of Young Chicks, G. E. Mann, *Malayan Agricultural Journal* Vol. XXIV, No. 5. 1936.

(2) Scientific Principles of Poultry Feeding, E. T. Halnan, Ministry of Agriculture and Fisheries, Bulletin No. 7, 1934.

(3) Farm Poultry Production, Card and Henderson.

THE RURAL LECTURE CARAVAN.

Compiled by Officers of the Co-operative Societies Department and of the Department of Agriculture.

A previous article by Corrie and Spring has been published* describing the original construction and fitting of the Rural Lecture Caravan, which is run jointly by the Co-operative Societies Department, the Department of Agriculture and the Rubber Research Institute of Malaya. This article also contained an account of the objects for which the Caravan is maintained and the methods of working used during the first few tours.

Subsequent experience led to certain modifications both in the equipment of the Caravan itself and in the general organization of its tours. In the present article these modifications are described and a summary is given of the work that has been done through the agency of the Caravan from the time the first tour was commenced in November, 1930, until the end of December, 1935.

Construction and Equipment.

The chassis purchased was a Morris 1½ ton lorry chassis costing $2,760.58 in 1930.

The Caravan was originally provided with a trailer for the conveyance and display of exhibits, photographs and models. This trailer and the coach-work body of the Caravan were built by the Federated Malay States Railways at a cost of $2,938.13. The body was originally fitted with two comfortable sleeping berths placed above clothes cupboards. It also had complete crockery and other furnishings and an oil burning cooking range. A full account of it is given in the earlier article referred to above. It was found, however, after a few tours that the driver and the cinematograph and lantern operator, who soon became the only two officers actually travelling in the Caravan, were able to obtain food for their needs everywhere in the country without cooking their own meals. Consequently, when the abandonment of the trailer and modifications in the lighting set, as described below, rendered necessary the provision of extra storage space in the Caravan itself, the internal fittings for cooking apparatus and crockery were all removed.

Trailer. This was fitted to take cases and bottles of agricultural exhibits, boxes of photographs and models of such things as improved copra kilns and poultry houses. It was so built that the two sides and the back could be let down to form tables for the display of these exhibits. Its body was carried on a light chassis provided with two wheels and a triangular coupling which could be attached to the back of the Caravan.

After a few months' experience it was found that the weight of the trailer caused an excessive strain on the back axle and differential of the Caravan. Furthermore, owing to the size of the body of the Caravan, the driver was unable

* *Malayan Agricultural Journal,* Vol. XIX, p. 229, May, 1931.

to see the trailer—a serious disadvantage in narrow roads. It was also impossible to reverse the Caravan into parking places whilst the trailer was attached. After considerable experience of these difficulties it was decided in September, 1932, to abandon the trailer entirely and to refit the interior of the Caravan to take all exhibits.

Modifications of Internal Fittings. The spaces below the sleeping berths were cleared of their original fittings and were divided up into shelves and cupboards to carry boxes of photographs, cases of glass bottles and flat show cases. The two partitions closing these spaces off from the central alley-way were each made in one piece. They were removable and fitted with folding metal legs, so that they could be used as tables for displaying exhibits. Space was provided under the two cupboards on either side of the back compartment for the two lighting sets described below. On either side of the Caravan was fixed a metal tube frame over which canvas could be stretched to provide shade for the tables; each frame was hinged so that it could be folded down against the side of the Caravan when not in use.

Lighting Set. The Caravan was first fitted with a dynamo which was driven by a belt passing over the outside of the tyre of one of the rear wheels, the latter being raised from the ground by a jack.

In practice, this arrangement gave very bad service. The 20 h.p. engine of the Caravan was run at full speed to do the 2 h.p. work of rotating the dynamo. The wear on the differential gear in consequence of driving one wheel at full speed for hours on end, whilst one wheel was motionless, made expensive replacements of this gear necessary in a few months, and later a complete replacement of the transmission became necessary. The belt used for the drive was the cause of considerable trouble and the light flickered and fluctuated and proved unreliable.

This system was abandoned in October, 1931, and a small $2\frac{1}{2}$ h.p. Blackstone engine was purchased for $200. It was found that satisfactory running was not possible with the small dynamo which had been affixed to the running board. A dynamo of stronger construction was obtained for $350 and fixed by direct drive to the Blackstone. This, mounted on a metal bed, is a complete power unit which may be moved from the Caravan and taken on launches for river trips. A second set of Blackstone engine ($200) and dynamo ($180) was purchased in December, 1933, thus allowing overhaul and repairs to be done at leisure without interrupting the tours of the Caravan. These composite lighting sets have not given entirely trouble-free service, and experience leads to the opinion that in the long run a stronger and somewhat heavier complete outfit, such as is made by manufacturers of lighting sets, would probably prove as cheap in the end and more efficient.

Loud Speaker. With the addition to the Caravan of lantern slides and lectures on them, it became necessary to employ artificial aid to the human voice. At first a megaphone was used, but this is almost impossible to use correctly when the lecturer is at the same time pointing to the screen. An amplifier, incorporating gramophone and microphone encased in a strong portable box, was provided in

1934 at a cost of $315. A long trumpet-shaped horn gives the sound constant direction towards the audience and prevents resonance in the microphone which must be stationed near to the screen.

It should be mentioned in concluding this account of the Caravan and its equipment that, before any construction work was commenced, information was obtained from such sources as were known concerning the design and fitting of similar caravans used for propaganda purposes in other tropical countries. At that time information was not very plentiful. Moreover it did not necessarily follow that a design and equipment suitable for another country would be best suited to conditions in Malaya. Consequently, although the information obtained was carefully considered, knowledge had to be acquired through local experience, a process involving some measure of trial and error. The original design and the various modifications found necessary have been described in some detail in the hope that experience in Malaya may prove useful to others wishing to construct and equip caravans for similar purposes in other parts of the tropics.

Weight of Caravan.

Owing to the size of the Caravan body, larger tyres were fitted and the rear axle springs were strengthened with an extra leaf to allow a safety margin for cornering. The total weights of the Caravan are not, however, excessive, although the additional weight of the lighting sets was not allowed for in the initial construction.

When loaded with lighting set, etc. ready for the road the weights of the Caravan are:—

Front axle	...	$18\frac{1}{2}$ cwts.
Rear ,,	...	$2\frac{1}{4}$ tons

Mileage.

The Caravan, although constantly on tour, does not cover a large mileage because the journeys are arranged so that visits are paid to successive points not necessarily very far apart, and the Caravan stays in each place two nights.

Approximately the mileages covered by the Caravan are:—

November 1930, to June 1932	...	10,000 miles
June 1932, to April 1934	...	10,000 ,,
April 1934, to December 1935	...	8,775 ,,

giving a total of approximately 30,000 miles in $5\frac{3}{4}$ years.

Miles per Gallon. The Caravan runs at about 14 miles per gallon on long runs with slightly lower figures on general running.

The bills from which the statements of costs are compiled include the petrol and oil used for the lighting set. The proportion of hours of lighting to hours of travelling varies slightly according to the tours; for instance a long run from Kuala Lumpur to Penang may form part of one tour, but the average tour works out at approximately a consumption of one gallon of petrol for 9 miles including both lighting and travelling. Lubricating oil consumption is not expensive as the mileage run by the vehicle is so low.

Summary of Tours.

The Caravan was completed in the third quarter of 1930 and commenced short experimental tours in November of that year. The following is a schedule of tours of the Caravan from 1931 to 1935. Some tours are short (of ten days' duration), others are long (up to three months' duration). After some experience of the Caravan, it was found that the period of five nights before full moon and five nights after full moon was unsuitable for projections on a screen standing in the open, owing to the light of the moon falling upon the sheet. Tours are, therefore, arranged to employ these ten nights in giving shows on estates or in places in which a covered hall can be secured.

Tours of the Caravan.

	Penang & P.W.	Perak	Selangor	Pahang	Negri Sembilan	Malacca	S'pore	U.M.S.	Total
1931	1	3	5	—	2	1	—	—	12
				(river mukims)					
1932	1	3	2	1	1	1	—	—	9
1933	1	3	4	1	1	1	—	—	11
1934	1	3	5	1	1	1	1	—	13
				(river mukims & P. Tioman)					
1935	2	2	2	1	3	2	—	Johore Kedah	14
								Total ..	59

Places Visited. A record is kept of every place in which a show is given and of the films and lectures which are given there. In the following schedule a summary of this record is shown. In certain towns, several shows have been given and this accounts for those places to which several visits have been made. In such cases, the audiences have not necessarily been composed of the same classes of persons; for instance in certain towns some shows may have been given of Malay films or lantern slides and at another opportunity a show may have been given of the Tamil films.

The Caravan has proved a most useful adjunct to District Agricultural Shows and it was to attend the State Shows at Alor Star and Muar that it visited Kedah and Johore in 1935.

It has also served a useful purpose in connexion with the All-Malayan Padi Competition, as advantage has been taken of the opportunity presented by the various tours in the last two years to give lectures on the points constituting a good sample of padi for exhibition purposes and on the more important faults in samples with their causes.

Summary of Places Visited.

	Visited once.	Visited twice	Visited 3 times	Visited 4 times	Visited 5 times	Visited 7 times	Total No. of Shows
Singapore ...	8						8
Malacca ...	32	11	4	1			70
„ estates ...	7						7
Negri Sembilan ...	20	11	7	1			67
„ estates ...	22	2					26
Selangor ...	26	16	9	1	1	1 (K. Lumpur)	101
„ estates ...	45	7					59
Pahang ...	37	16	3	1			82
„ estates ...	3						3
Perak ...	59	22	11	9	2		182
„ estates ...	8						8
Penang and Province Wellesley ...	22	4	3	3			51
„ estates ...	8						8
Kedah ...	1						1
Johore ...	1						1
Total number of shows given, 1931 to 1935 ...							674

Programmes.

Instruction given through the medium of the Caravan has two distinct purposes. The first is to show the peasants in a general way by means of the films that improvements in existing conditions or methods are possible in various directions. When interest has been aroused in the possibilities in any one direction, then the second purpose is to give detailed information in lectures, illustrated by lantern slides or by models, specimens and photographs, on one specific subject such as is shown in the list given below.

In the earlier years the Caravan remained at each centre visited for one night only, but as it was found that the programme tended to become overloaded and mentally indigestible, the experiment was tried at the end of 1934 of extending each visit to two days, the films being shown usually on the first night and lectures on specific subjects being given on the second afternoon and evening, with possibly one film to conclude the programme. This procedure has been continued regularly since the beginning of 1935. The exact arrangement of the programme varies somewhat, but it has been found advisable to restrict the lectures to not more than two subjects if the information given is to be effectively absorbed. Lighter entertainment is provided in the form of a film cartoon, and of gramophone records of Malay or Indian music played during intervals in the programme.

Lectures illustrated by models and other exhibits are given between 4.30 or 5 and 6 o'clock in the evening, while those illustrated by lantern slides commence about 7.30 or 8 p.m. and the whole night's programme may continue until well after 10 p.m.

The subjects of the films shown and the lectures given naturally vary according to the interests of the audience and the crop or crops of major importance at each centre. Thus films and lantern slides dealing with the problems of rubber small-holders are shown in centres where rubber is the most important crop, while in other places the subjects may be coconuts or padi. Other films of more general application, such as the co-operative films inculcating thrift, are suitable for inclusion in most programmes.

The lectures are actually delivered by the Malay Co-operative Officer, one or more of the Agricultural Assistants and the Rubber Instructor stationed in the area in which the Caravan is touring, each on his own subject. Notes drafted by European officers are supplied on agricultural subjects.

It is usual to invite a local Chief or Headman to preside at the meetings at each centre visited, in order to add dignity and a measure of formality to the occasion.

Attendances at afternoon lectures vary from about 50 to 200, and at evening displays from about 200 to 2,000 persons according to the density of the population in the neighbourhood of the particular centre visited.

Films. The following films are carried by the Caravan:—

Title	No. of Reels	Audience	Lesson of the Film
Mat and Idris ...	3	Malay	Thrift
Saving of Hj. Hassan ...	4	,,	Production of better rubber.
Food First ...	4	,,	Production of foodstuffs.
Rezeki ...	2	,,	Cultivation of padi.
Padi ...	3	,,	Use of selected padi strains.
Eggs ...	1	,,	Marketing of eggs.
Pengkalen Lomba ...	4	,,	General Co-operation.
Manap & Mahmud ...	2	,,	Animal husbandry.
Malay Regiment ...	1	,,	Malay Regiment's activities.
Cartoon ...	1	—	Introductory film.
Malaya, the Land of Opportunity ...	5	Tamil	Thrift.
How Govindan saved Money ...	2	,,	Vegetable allotments.
How Karuthan saved Money ...	2	,,	Animal husbandry.

(The last two films, photographed in 1935, will be available for the Caravan in 1936).

All these films were produced and photographed by members of the Departments concerned, with the village people themselves, or in a few cases Malay professionals, as actors.

Lantern Slides. The following subjects are dealt with by lantern slides or by means of models and exhibits, or both, with appropriate lectures thereon:—

Mouldy Rot disease of rubber trees.
Preparation of sheet rubber on small holdings.
A rubber smoke cabinet for small-holders.
Poultry housing.
Copra production.
Minor crops for small-holders.

Cost of Films.

The cost of cameras and projectors and other necessary equipment for film work cannot easily be apportioned to the films which are produced for the Caravan, because it is necessary to keep such equipment up to date by occasional replacements and renewals. These items are therefore shown separately in the schedules attached.

The cost of films includes the emoluments paid to actors, and necessarily includes the percentage of film scenes photographed, but discarded during editing or requiring to be re-photographed for various reasons. This percentage varies mainly with the skill of the photographer in obtaining correct exposure and with the skill of the actors in performing their parts. In films used for propaganda purposes, it is essential that the actors should be natural and the background and scenery should be that to which the audience is accustomed. This precludes to a great extent the use of stage effects. There is an element of luck in obtaining actors who manifest spontaneously the ability to perform their parts. The expense entailed in photographing certain scenes two or three times until the action is natural is probably not as great as the expense which would be entailed in employing very good actors (if they were available) and relying upon make-up and stage effects to achieve the requisite appearance and naturalness.

The expense of the films has varied a great deal in each case. The average works out at approximately $200 per reel of 400 feet including all titles and captions.

Results.

Although the Caravan tours sow the seeds of new ideas and provide more detailed instruction to a certain number of interested individuals, they have to be followed up for several months by lectures, demonstrations and advice from the local officers of the two Departments and the Institute, to ensure that the lessons first taught from the Caravan are translated into action by the majority of peasant proprietors in any given area.

By these means definite results have been achieved. One such result has been an increase in the number of General Purposes Co-operative Societies. These are formed for improving village surroundings by maintaining access paths and

mosque compounds, and by removing litter from the neighbourhood of houses; for constructing minor irrigation works for padi fields, for destroying rats, squirrels or wild pigs when such pests are numerous enough to do serious damage to crops; and for carrying out any similar work of general benefit to the health and prosperity of village communities. Other results have been the greater production of copra of improved quality by land owners themselves on approved types of kiln, the preparation of rubber sheet of better quality, the use of the small smoke cabinet in various localities, the more extended use of pure strain padi in the main rice growing areas, and the better housing and better care of poultry in some districts.

Running Costs of the Caravan from 1929 to 31st December 1935.

(a) On purchase:		
Caravan and fittings ...	$9,102.54	
Loud-speaker, etc. ...	315.00	
Blackstone engines and lighting equipment	1,257.90	$10,675.44
(b) On running:		
Wages ...	5,770.00	
Petrol ...	2,502.81	
Oil ...	178.40	
Tyres ...	258.20	
Punctures ...	10.20	
Lamp bulbs and torches ...	728.80	9,448.41
(c) On repairs:		
Caravan and Blackstone ...	3,540.89	
Painting ...	54.10	
Projectors ...	386.46	3,981.45
(d) On films:		
Cost of films ...	6,219.40	
Cost of copies ...	1,755.19	7,974.59
	Total	$32,079.89

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A NOTE ON THE GERMINATION OF PADI

BY

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It is considered generally that freshly harvested padi cannot satisfactorily be used for seed purposes. Among Malay padi planters the belief appears to be current that seed padi should be not less than 100 days old, and it is further opined that such plants as are raised from newly harvested padi do not fruit well. Lord* states that newly harvested seed, unless dead ripe, will not germinate but that after a period of 2 to 2½ months a satisfactory germination is obtained. At Titi Serong, a small experiment designed to examine the above contentions was conducted after the harvest of 1936.

Methods.

An area of Mayang Ebus 208 was allowed to become dead ripe before cutting on 20th February 1936 and the seed reserved for the experiment. On 27th February, and thereafter at 7 days intervals, four lots of 1,000 sound grains were counted out. The samples were enclosed in small muslin bags and soaked in water for 2 days and 2 nights and then air dried for 2 days and 2 nights. On the morning of the fifth day, the number of grains which had germinated was recorded. The method adopted is the normal practice at Titi Serong and the procedure was standardized to ensure that the weekly germination counts would be comparable.

Results.

The percentage weekly germinations of the four samples together with the mean and the standard error of the mean are presented below:—

Table I.
Percentage Weekly Germination of Seed.

No. of Weeks from Harvest	Percentage Germination of Seed					Standard Error of Means
	No. 1	No. 2	No. 3	No. 4	Mean	
1	13.5	15.7	16.8	13.5	14.9	0.66
2	21.5	28.0	26.9	22.0	24.6	2.77
3	40.0	48.7	47.6	38.8	43.8	6.5
4	63.6	78.3	73.5	67.0	70.6	10.8
5	80.7	77.8	74.2	84.7	79.4	4.95
6	96.8	93.2	82.4	96.3	92.2	11.25
7	99.0	98.4	98.4	98.1	98.5	0.04
8	99.2	98.5	98.4	98.3	98.6	0.04
9	99.2	99.0	91.1	97.9	98.8	5.02
10	99.2	88.5	98.3	99.1	96.3	6.76
11	99.5	99.1	99.2	99.1	99.2	0.01
12	99.4	99.2	98.9	99.5	99.3	0.02

* The Cultivation of Rice in Ceylon, *Empire Journal of Experimental Agriculture*, Vol. 3. p. 123.

Under the conditions of the trial, it would appear that very new seed does germinate poorly but the germination rapidly improves as the seed ages until, at the end of the sixth week after cutting, a quite satisfactory figure is obtained. Subsequently, the germination is only slightly enhanced with age. The trial was discontinued after the twelfth week when, with seed still less than 100 days old, a 99 per cent. germination was obtained. However, whether or not the contention that plants raised from very fresh seed padi do not yield heavily is a correct one still remains to be examined.

As stated, the method adopted is the customary one at Titi Serong Experiment Station but it was found in the early weeks that, if after the first soaking and drying, the seed was re-soaked, or the initial soaking prolonged to three days, or if counts were continued on the sixth and seventh day after taking the sample, the germination was much better. It is probable that, should circumstances arise in which the use of freshly harvested seed padi is unavoidable, a quite good, if slow, germination would be obtained by a longer or a double soaking.

Received for publication 5th August, 1936.

CONDITIONS ON RUBBER SMALL HOLDINGS IN MALAYA.

3rd Quarter, 1936.

Prepared by the Economics Branch of the Department of Agriculture, Straits Settlements and Federated Malay States, in collaboration with the Field Branch of the Department.

Rainfall.

The quarter was exceptionally dry with conditions approaching those of drought in many districts during July and August; heavy rains were experienced fairly generally in the second half of September. The exception to these conditions was the Malacca Settlement where July and August were wet months, and September dry.

Prices.

Table I shews the lowest and highest prices paid for small-holders' rubber throughout Malaya, Table II giving the mean of the range.

Prices were on a slightly higher level, the difference between the extremes of ranges being notably reduced. Prices for unsmoked sheet and scrap were also higher, the former being, in many cases, only slightly less than for the smoked grade.

Production.

Figures of production of rubber on small holdings during the quarter are published in Table III. This table is compiled from the monthly report of production, stocks, imports and exports of rubber published by the Registrar-General of Statistics, S.S. and F.M.S.

Tapping.

Table IV shews the results of the quarterly survey of small holdings out of tapping. The estimates are obtained by counting the number of holdings out of tapping, and applying the percentage to the total area of small holdings in the District.

An additional table (Table V) is included in this report, shewing, for the purpose of comparison, corresponding figures for 1935 and for the end of the second quarter of this year.

It will be noted that there was a general increase in holdings in tapping, and this appears to be principally due to the higher price obtainable for uncouponed rubber.

Condition of Holdings.

Some repoıts criticize adversely the condition of holdings, particularly those of absentee landlords, although a Johore report states that the improved economic position of the small-holder is reflected in increased activity in the holdings in the form of slashing of undergrowth, digging drains and repairing existing ones.

Table I.

Lowest and Highest Rubber Prices Paid by Local Rubber Dealers.
(In Straits dollars per picul (133 1/3 lbs.))

3rd Quarter 1936.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore
JULY								
Smoked sheet	33.00-35.00	32.00-34.85	32.80-35.00	31.50-35.00	31.00-36.10	32.00-34.50	30.50-35.20	32.00-35.00
Unsmoked sheet	32.50-34.80	30.00-34.60	30.00-34.30	31.50-34.00	25.50-33.50	30.00-32.50	28.00-34.00	29.00-34.70
Scrap	22.50-28.50	—	27.00-28.30	—	—	28.00-30.50	26.00-30.00	25.00-30.00
AUGUST								
Smoked sheet	33.00-35.00	32.50-34.80	32.60-34.50	32.00-35.00	30.00-34.50	32.50-34.50	31.00-34.50	32.00-34.60
Unsmoked sheet	32.50-34.20	28.10-33.90	30.00-33.80	31.50-33.80	25.00-33.50	30.50-33.00	29.00-33.70	29.00-34.00
Scrap	19.00-28.50	—	28.00-28.50	—	—	27.50-31.00	28.00-29.70	25.00-29.00
SEPTEMBER								
Smoked sheet	33.00-34.51	32.80-34.80	32.00-35.00	31.80-35.50	30.00-34.60	33.00-34.50	33.00-34.80	32.00-34.30
Unsmoked sheet	32.80-34.10	30.00-33.65	31.00-34.00	31.50-33.60	27.00-33.25	32.00-33.50	31.20-33.50	29.00-33.50
Scrap	23.50-28.50	—	26.00-29.30	—	—	27.00-30.00	27.00-29.50	25.00-28.50

Table II.

Mean of Lowest and Highest Rubber Prices Paid by Local Dealers at a number of Centres in each State.

(In Straits dollars per picul (133 1/3 lbs.))

3rd Quarter 1936.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore
			JULY					
Smoked sheet	33.94-34.84	33.03-34.28	33.55-34.50	32.72-34.62	32.48-34.42	32.83-33.83	33.18-34.80	33.08-34.18
Unsmoked sheet	33.03-33.95	31.54-33.16	31.56-33.53	31.80-33.48	30.12-31.64	31.17-32.00	31.38-33.83	31.64-33.11
Scrap	25.38-26.75	—	27.50-28.15	—	—	28.50-29.33	26.83-29.00	26.37-27.34
			AUGUST					
Smoked sheet	33.91-34.61	33.22-34.06	33.08-33.91	33.10-34.43	32.00-33.87	33.17-34.00	33.00-34.26	33.23-33.92
Unsmoked sheet	32.68-33.68	31.31-32.57	31.03-32.58	32.00-33.40	29.84-30.85	31.50-32.50	31.50-32.30	31.90-32.88
Scrap	24.50-26.20	—	28.00-28.50	—	—	28.00-29.50	28.17-28.90	27.31-28.19
			SEPTEMBER					
Smoked sheet	33.75-34.47	33.16-33.99	33.08-34.28	33.02-34.30	32.23-34.02	33.33-34.33	33.30-34.12	33.14-33.75
Unsmoked sheet	32.95-33.70	31.52-32.54	31.50-32.75	31.96-33.05	29.85-31.05	32.33-33.33	32 08-33.00	31.66-32.65
Scrap	25.75-27.00	—	27.50-27.90	—	—	28.50-29.33	27.83-29.33	26.84-27.73

Table III.

Production of Rubber on Small Holdings.

(in tons)

	Total Jan.-Sept. 1935	1st Quarter 1936	2nd Quarter 1936	3rd Quarter 1936	Total Jan.-Sept. 1936
Federated Malay States ...	53,365	14,796	13,108	17,437	45,341
Unfederated Malay States ...	42,874	11,561	13,549	15,314	40,424
Straits Settlements ...	10,240	2,997	3,019	3,245	9,261
Total ...	106,479	29,354	29,676	35,996	95,026

Diseases.

Mouldy Rot continued to be the disease most prevalent throughout small holdings, but the dry weather was not conducive to its spread, and it was only at the end of the quarter in most districts that the disease assumed serious proportions. Root Disease was prevalent, but small-holders could not be induced to make any effort to effect its control. A few cases of Pink Disease were reported from some districts.

The practice of allowing undergrowth has reduced the risks of erosion, but mention is made in the Negri Sembilan report of excessive erosion in some Districts of that State, where no control measures have been undertaken.

Grades of Rubber.

The small margin between the prices paid for smoked and unsmoked sheet has naturally resulted, in most States, in a marked preference for the production of the unsmoked grade. On the other hand it is evident that the campaign to encourage the small-holder to erect the cheap form of smoke-house is having a very definite effect in some localities.

Kedah.—There was a considerable increase in the quantity of smoked sheet purchased, and a big decrease in the sale of scrap rubber with the exception of the Kuala Muda District. The percentages of smoked sheet, unsmoked sheet and scrap respectively were: North Kedah 91.3, 2.4, 6.3, Central Kedah 66, 9, 25; South Kedah 50, 44, 6.

Table IV.

Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less than 100 Acres, at the end of September, 1936.

PERAK

District	Total Tappable area	Total area untapped	Percentage
Batang Padang	33,227	6,645	20
Kinta	36,090	4,691	13
Kuala Kangsar	79,572	24,667	31
Upper Perak	12,680	5,072	40
Larut & Selama	38,216	10,316	27
Krian	9,270	6,025	65
Lower Perak*	25,982	8,054	31
Dindings	9,273	7,882	85
	244,304	73,352	30

SELANGOR

District	Total Tappable area	Total area untapped	Percentage
Klang	15,410	6,472	42
Kuala Langat	23,333	7,233	31
Ulu Langat	39,856	13,959	35
Ulu Selangor	25,857	15,772	61
Kuala Lumpur†	19,327	8,117	42
Kuala Selangor†	9,512	3,995	42
	133,295	61,548	46

NEGRI SEMBILAN

District	Total Tappable area	Total area untapped	Percentage
Seremban	22,176	17,962	81
Tampin	16,961	11,703	69
Kuala Pilah	26,586	20,737	78
Jelebu	8,917	2,140	24
Port Dickson	11,634	5,235	45
	86,274	57,777	67

PAHANG

District	Total Tappable area	Total area untapped	Percentage
Raub	9,342	4,764	51
Kuala Lipis	14,588	1,750	12
Bentong	11,574	2,893	25
Other Districts†	40,383	11,711	29
	75,887	21,118	28

MALACCA

District	Total Tappable area	Total area untapped	Percentage
Central	13,109	2,621	20
Alor Gajah	30,203	9,060	30
Jasin	22,883	2,745	12
	66,195	14,426	22

PENANG & P. WELLESLEY

District	Total Tappable area	Total area untapped	Percentage
North	3,941	433	11
Central	9,540	4,201	44
South	7,508	5,480	73
Penang	15,822	1,265	8
	36,820	11,379	31

SINGAPORE

District	Total Tappable area	Total area untapped	Percentage
Singapore	20,591	617	3
	20,591	617	3

	Total Tappable area	Total area untapped	Percentage
JOHORE	322,225	77,334	24
KEDAH	100,691	39,269	9

The percentage of areas out of tapping in June, 1936, was as follows:—Perak 31, Selangor 53, Negri Sembilan 57, Pahang 34, Malacca 36, Penang and Province Wellesley 30, Singapore 4.

* Estimated from percentage for Kuala Kangsar.

†Estimated from percentage for other Districts in the State.

Table V.

Comparison of Areas of Rubber Small Holdings Out of Tapping.

	September, 1935		June, 1936		September, 1936	
	Acres	Percentage	Acres	Percentage	Acres	Percentage
F.M.S.	145,200	27.2	219,328	40	213,795	39.6
S. S.	24,000	20.6	35,595	29	26,422	21.3
Johore	not available		103,112	32	77,334	24
Kedah	not available		42,300	42	39,269	39
Malaya*	—	—	400,335	36.8	356,820	32.8

*Ignoring Perlis, Kelantan and Trengganu, in which States the area of rubber small holdings is relatively small.

Perak.—The ratio of smoked to unsmoked sheet at Bagan Serai again rose slightly to 36.25 to 63.75. In Selama most of the sheet is smoked. In Trong the proportion of smoked sheet rose from 46 per cent. in July to 88 per cent. in September, but quantities bought in the latter month were comparatively small, and it is likely that most of the small-holders, who normally produce unsmoked sheet, disposed of their crop early in the quarter when the issue of coupons took place.

In Perak Central the proportion of smoked sheet was 64 per cent., to 36 per cent. of unsmoked sheet, but this high percentage of smoked sheet does not necessarily represent the work of the small-holder himself, as many pay to have their sheet smoked by Chinese. In Perak South the percentages were: smoked 42, unsmoked 58.

Selangor.—A marked preference continues to be shewn for smoked sheet.

Penang and Province Wellesley.—With the premium for smoked sheet being reduced, most small-holders owning smoke-cabinets stopped using them. Percentages of grades were: smoked 9, unsmoked 79, scrap 12.

Malacca.—There was a slight increase in the percentage of unsmoked sheet in all Districts; percentages of smoked and unsmoked respectively were: Central 78.6, 15.8 (scrap 5.6); Alor Gajah nil, 99; Jasin 23, 76.

Negri Sembilan.—Preference for unsmoked sheet was shewn in most localities, and the mean of percentages of purchases by 27 dealers was: smoked 47 per cent., unsmoked 53.

General.

The rubber dealers' scheme in Pahang continued to work smoothly, and marked improvement in the quality of sheet rubber is reported from the Temerloh and Lipis Districts. The Pahang report also states that the restriction of new planting is causing large areas of new lands to be planted with fruit and other economic food crops.

It is reported from Johore Central that young rubber is being brought into tapping, the incentive being the good prices obtainable in the District for un-couponed rubber. On the contrary, in Pahang the tapping of young rubber is inclined to be postponed slightly in all districts until the trees are of a fair size.

Arrangements are being made for the budgrafting of a holding of 30 acres belonging to a Muar small-holder.

Twenty-eight new smoke-houses were erected during the quarter, and five more are under construction.

Reviews.

The Oriental Migratory Locust (*Locusta migratoria manilensis* Meyen) and the Bombay Locust (*Patanga succincta* L.) in Malaya.

By G. H. Corbett and N. C. E. Miller, Special Bulletin, Scientific Series No. 18, Department of Agriculture, Straits Settlements and Federated Malay States, 1936, 15 pp. Price 50 cents (Straits Currency) or 1s. 2d. post free.

In the above bulletin, Messrs. G. H. Corbett and N. C. E. Miller give an interesting summary of the appearances in Malaya of the Oriental Migratory Locust and the Bombay Locust.

This paper will be of particular significance to those who experienced locust swarms in parts of this country between 1913 and 1917, and it is one that is commended to the attention of all who have any local agricultural interests at the present time.

Its fifteen easily-read pages ending with a bibliography of the relevant literature are supplemented by a preface written by the Acting Director of Agriculture (who himself took an active part in the former Locust Destruction Campaign), and after the text there is a plate showing the locality in which a subsequent, isolated outbreak occurred in 1930 (fortunately detected and dealt with before more serious consequences could develop), and two maps of Malaya shaded to show the local distribution of the two species concerned.

Locusts, like embers, are liable to cause immense damage if neglected, and the writers of this paper have done a real service in focussing attention once more on these potential devastators.

H. M. P.

Annual Report of the Departments of Agriculture, Malaya, for the year 1935.

By H. A. Tempany, C.B.E., D.SC., F.I.C., F.C.S., *Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States. F.M.S. Government Press, Kuala Lumpur, F.M.S., 1936, 84 pp. Price 50 cents (Straits Currency) or 1s. 2d. post free.*

This report is in five sections, and although it approximates very closely to the general form of previous reports, certain modifications have been introduced into it.

Section I contains information regarding weather conditions, various major and minor crops, sugar and alcohol, livestock, dairy produce, poultry and eggs

and feeding stuffs for animals, while Section II is concerned with the work of the Department of Agriculture. Section III deals with the Advisory Committee, Section IV with finance, and Section V contains a summary of agricultural legislation enacted during 1935.

The reviewer draws the attention of the reader to the fact that this is the last annual report presented by the Director, who, in conclusion, states "in the seven years during which I have had charge of the Department of Agriculture the whole of the departmental working has been brought under review, and complete reorganisation effected of practically the whole of the agricultural services. During the same period the operation of the Department has greatly extended and many new lines of work have been undertaken."

This report will be found valuable by those who wish to obtain information regarding progress made in the scientific and educational work carried out by the Department of Agriculture and by those who desire facts concerning the agricultural position during 1935.

N. C. E. M.

Reports of the Research, Economic and Agricultural Education Branches for the Year 1935.

Special Bulletin, General Series No. 24, Department of Agriculture, Straits Settlements and Federated Malay States, 1935, 89 pp. Price 50 cents (Straits Currency) or 1s. 2d. post free.

This bulletin summarizes the work of six divisions of the Research Branch (the Division of Economic Botany having been incorporated with the Division of Soils and Plant Physiology), and of the Economics and Statistics and Agricultural Education Branches.

The information supplied is more complete than that published in the Annual Report of the Adviser on Agriculture, and will undoubtedly be of considerable interest to planters and others engaged in agricultural work both in Malaya and in other tropical countries.

N. C. E. M.

Malayan Agricultural Statistics 1935.

By D. H. Grist. Special Bulletin, Economic Series No. 7, Department of Agriculture, Straits Settlements and Federated Malay States 1936. Price 50 cents (Straits Currency) or 1s. 2d. post free.

With certain additions this bulletin follows the lines of previous bulletins on the same subject. It concerns Malayan agriculture in 1935 and comprises import and export figures, for a period of several past years, of agricultural products, areas and production of the principal agricultural crops, market prices in 1935 and figures in relation to livestock. Meteorological data are also supplied. The present number has 90 tables, two graphs and an adequate index.

N. C. E. M.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports from Agricultural Officers.

October, 1936.

The Weather.

The frequent showers characteristic of October weather prevailed throughout the country, but the total precipitation was below normal at nearly all stations, except those in Malacca and Kelantan.

In Malacca and the adjoining areas of Tampin in Negri Sembilan and Muar in Johore, unusually heavy rain fell during the second half of the month and the total precipitation was much above normal. In Kelantan, the monsoon rains began on the 15th and very heavy falls occurred during the last few days of the month.

Short spells of comparatively dry weather at the beginning of the month are recorded in parts of Kedah, South Perak, Selangor and Kelantan.

Remarks on Crops.

Padi.—In Kedah, flooding occurred early in the month in Kota Star and Kuala Muda, over 4,000 acres in the former and some 800 acres in the latter District being inundated. In Kuala Muda the floods which were occasioned by overflow of the Muda river, quickly subsided and little damage was done to the crop; but in Kota Star over 2,000 acres of padi were destroyed, though it is expected that all save some 300 acres of this will be replanted.

There was also some flooding of the crop in parts of Malacca at the end of the month, but at the time of report no estimate of damage was possible as the floods had not sufficiently subsided.

Harvesting has commenced at Kajang in Selangor and in the Temerloh and Bentong Districts of Pahang and in some of the Pahang river areas.

In other parts where the crop has been planted or planting is in progress the weather was conducive to good growth.

At Panchang Bedena in Selangor conditions had improved considerably at the end of the month, but water was still insufficient for transplanting over most of the area. In Kelantan, the late planted dry padi shows only moderate growth and tillering but the early planted dry padi and all wet padi are very promising.

Rubber.—The price for all grades of rubber increased slightly.

Three further smoke cabinets were erected in Perak South Circle, two in Pahang, one in Malacca, and four in Johore.

Tests of locally sold coagulants for the presence of sulphuric acid show that the position varies considerably in different parts of the country. For instance,

whilst it is reported that none was encountered in Johore North Circle, sulphuric acid was found to be in fairly common use in Johore Central Circle.

In response to the wishes of the owners, arrangements have been made for budgrafting to be done under the advice and supervision of the Rubber Research Institute on one Asiatic estate in Kedah, two holdings in Perak South Circle and one in Johore.

Coconuts.—The price of copra remained firm with the Penang quotation for sundried around $6 per picul. It reached $6.29 on the 30th.

The exceptionally severe seasonal decline in crop noted last month for Province Wellesley appears to be general and is specially stressed in reports from Johore where the decline is stated to be not only more severe than usual, but also more prolonged. The shortage of nuts has resulted in increased prices being paid, in a number of localities, for those used for domestic purposes.

Agricultural Stations and Test Plots.

Agricultural Stations.—Recent systematic work on the analysis of the roots of various species and varieties of Derris has enabled a review to be made of the tuba planted on Agricultural Stations and of the sources of supply, and advice has been given to replace all inferior material with plants of greater toxic value.

The Gaja Mati Station in Kedah has been extended by taking in a further 2 acres of jungle, part of which will be utilized for poultry.

At Kuala Kangsar Station in Perak, chlorosis of coffee, which appeared to have yielded to treatment last year by the application of ammonium sulphate, has reappeared, possibly as the result of the dry weather experienced during the past few months.

At Tanah Rata Station, Cameron Highlands, a good start has been made in raising seedlings of *Cinchona succirubra* as stocks for the budding of *Cinchona Ledgeriana*, with a view to increasing the area under this plant.

In Johore, at the Kota Tinggi Agricultural Station, work was completed on clearing the area set aside for pineapple experiments and selections, whilst fencing was completed on the Tongkak and Central Agricultural Stations.

Padi Stations and Test Plots.—Reaping commenced at Kajang Plot in Selangor and at the Kerbau Plot in Temerloh, Pahang, whilst the plants are flowering on Bawang and Pekan Plots in Pahang. Growth is disappointing on Ulu Klawang Plot in Negri Sembilan and at Kuala Linggi Plot in Malacca. The dry padi at Bachok Station in Kelantan has made poor growth and seedlings of wet padi are scarce, owing to a number having been lost in the nurseries from drought. Insufficient water prevented transplanting at the Panchang Bedena Plot in Selangor, but it is anticipated that it will be possible to commence early in November.

On all other Stations and Plots growth is reported to have been satisfactory during the month.

DEPARTMENTAL NOTES.

Visits of the Adviser on Agriculture.

The Acting Adviser on Agriculture visited Penang, Province Wellesley, Krian, and the South Circle of Perak from the 26th to 29th October for the purpose of inspecting Agricultural Stations and Padi Test Plots.

Agricultural Leaflets.

Leaflet No. 13 on Maize is now available, and can be obtained free on application to the Department of Agriculture, S.S. & F.M.S., Kuala Lumpur.

Rural Lecture Caravan.

The Rural Lecture Caravan continued the interrupted tour commenced in July last and visited Kuala Pilah District and one centre in Tampin. Weather conditions made it necessary to cancel one or two performances but otherwise the tour was successful.

Leave.

Mr. R. B. Jagoe, Assistant Botanist, returned from leave on the 23rd October, and resumed duty on that date.

Statistical.

MARKET PRICES.

October, 1936.

Major Crops.

Rubber.—The market improved again steadily throughout the month, and, towards the close, the price rose steeply with the announcement of the International Rubber Regulation Committee's decision to permit an additional release of 5 per cent. for the first half of 1937.

Spot loose opened in Singapore at 27 cents per lb. rising, on the 24th to $27\frac{1}{2}$ cents at which figure it remained until the 28th when it rose sharply to $28\frac{1}{8}$ cents, closing at 28 11/16 cents on a still rising market.

The average price for the month of No. 1. X. Rubber Smoked Sheet was 27.49 cents per lb. as compared with 26.65 cents in September. The London average price was 7.88 pence per lb., and the New York price 16.44 cents gold, as compared with 7.68 pence and 16.36 cents gold in September.

Prices paid for small-holders' rubber at three centres during the month are shewn in the following table.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, October, 1936.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.					Kuala Kangsar, Perak.				Batu Pahat, Johore.			
	1	8	15	22	29	7	14	21	28	7	14	21	28
Smoked sheet	34.25		35.10				34 35	34.66	33.55				
Unsmoked sheet	33.79	33.11	33.99	33.00	33.92	32.01	32.00		33.50	33.00	33.20	33.20	33.50
Scrap													

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent.

Palm Oil.—Table II shews the trend of the market for the Malayan commodities during October.

Table II.
Prices of Palm Oil and Palm Kernels.

Date 1936.	Palm Oil in Bulk, c.i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
October 2	£ 22. 0. 0	£ 10. 15. 0
,, 9	22. 0. 0	11. 2. 6
,, 16	21. 0. 0	11. 0. 0
,, 23	21. 0. 0	11. 10. 0
,, 30	23. 0. 0	11. 15. 0

Copra.—With keen buying enquiry prices rose steadily and considerably during the month. The sun-dried grade opened in Singapore at $5.35 per picul, and closed at $6.20, the average for the month being $5.83 per picul as compared with $5.58 in September. The mixed quality averaged $5.49 per picul as against $5 in the previous month, the difference in price between the two grades being reduced.

Copra cake continued unchanged throughout the month at $2 per picul.

Rice.—The average wholesale prices of rice per picul in Singapore in September were as follows:— Siam No. 2 (ordinary) $3.75, Rangoon No. 1 $3.47, Saigon No. 1 $3.77, as compared with $3.85, $3.47 and $3.57 respectively in August. The corresponding prices in September 1935 were $4.29, $3.75, and $3.77.

The average retail market prices in cents per gantang of No. 2 Siam rice in September were: Singapore 25, Penang 28, Malacca 26, as compared with 26, 30 and 26 respectively in August.

The average declared trade value of imports of rice in September was $3.60 per picul, as compared with $3.52 in August and $3.57 in July.

Padi.—The Krian Government Rice Mill maintained its price at $1.90 per picul throughout October. Retail prices of padi ranged from 6 to 14 cents per gantang.

Pineapples.—Prices weakened on reports that stocks in the United Kingdom were large, and on lack of buying enquiry. Closing prices per case were: Cubes $3.25, Sliced Flat $3.05, Sliced Tall $3.35.

Prices of fresh fruit per 100 were as follows:— Singapore $2.20 to $2.30; Selangor $1.20 to $1.50; Johore 1st quality $1.80 to $4, 2nd quality $1.40 to $4, 3rd quality 70 cents to $2.

Beverages.

Tea.—Nine consignments of Malayan tea were sold on the London market during October and the last week of September. One consignment was of upland tea and was sold at 1s. 0¼d. per lb.; the lowland tea ranged from 11¼d. to 11¾d. per lb.

Average London prices per lb. during October for consignments of tea from other countries were as follows:— Ceylon 1s. 1.79d., Java 11.07d., Indian Northern 1s. 1.31d., Indian Southern 1s. 0.02., Sumatra 10d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report*, 27th October, 1936, of the Colombo Brokers' Association, and are as follows, in rupee cents per lb:— High Grown Teas 71 cents, Medium Grown Teas 67 cents, Low Grown Teas 64 cents.

Coffee.—Sourabaya coffee weakened again slightly in Singapore during the month, averaging $12.30 to $13.30 per picul as compared with $12.50 to $13.50 in September. Palembang coffee improved to average $7.75 to $9.25 per picul as compared with $6.70 to $8.05 in the previous month.

Spices.

Arecanuts.—The following are the averages of the ranges of prices per picul in Singapore during October: Splits $4.75 to $7.05; Red Whole $5 to $6; Sliced $7.85 to $9.95.

The Singapore Chamber of Commerce prices weakened during October, and average prices per picul were: Best $6.96, Medium $6.54, Mixed $5.85.

Pepper.—The announcement that the London Pool had raised its selling limit resulted in speculative buying on this side, and quotations shewed a substantial advance. This improvement was, however, only temporary, and prices fell back at the close. Average prices per picul for the month were: Singapore Black $8.20, Singapore White $14.90, Muntok White $15.70, as compared with $7.25, $13 and $13.14 respectively in September.

Nutmegs.—Both 110's and 80's were quoted at the same prices during October, and after weakening in the middle of the month, improved at the close, averaging $28.80 per picul as compared with $29.25 and $29.75 respectively in the previous month.

Mace.—Siouw improved to close at $100 per picul, averaging $94 per picul as compared with $92.50 in September. Amboina weakened in price, and averaged $78.40 per picul as against $82.50 in the previous month.

Cardamoms.—Green cardamoms were quoted during October in the Ceylon Chamber of Commerce reports at Rs.1.60 to Rs.1.87 rising at the close to Rs.1.85 to Rs.1.98 per lb.

Miscellaneous.

Derris (*Tuba Root*).—More enquiries were in evidence during October but prices remained unchanged at the September levels of $48 per picul for roots sold on a basis of rotenone content, and $30 per picul for roots sold on a basis of ether extract.

Gambier.—Prices in Singapore improved still further in October, Block being quoted at $5.25 per picul throughout the month and No. 1 Cube at $10.50, as compared with $5 and $10 respectively in September.

Tapioca.—Singapore prices remained unchanged throughout the month, and were: Flake, Fair $5.50, Seed Pearl $5.75, Medium Pearl $6.50 per picul.

Sago.—Keen buying enquiry improved prices considerably in Singapore during October. Average prices per picul were: Pearl, Small Fair $4.63, Flour, Sarawak Fair $3.13, as compared with $4.38 and $2.86 in the previous month.

Tobacco.—Prices of locally grown tobacco varied considerably, the general range per picul being: 1st quality $18 to $47, 2nd quality $14 to $32, 3rd quality $10 to $21.50. In Kelantan the range was $90, $70 and $50, and in Johore $90, $75 and $25, while in Selangor $100 was quoted for the 2nd quality and $75 for the 3rd.

Charcoal.—This commodity is again in demand at prices which leave a reasonable margin of profit. A leading buyer is prepared to take between 200 and 300 tons a month in 100 ton lots. Price quotations are difficult to obtain but it has been learned that, in May last, London was quoting £8 per ton sellers, £7.15s. buyers.

The issue of this Journal for April, 1935, contained a useful summary of information on the subject of coconut charcoal, and copies may be purchased on application.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Kohyei & Co., Singapore.

1 picul = $133\frac{1}{3}$ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57 Trafalgar Square, London, W.C. 2.

GENERAL RICE SUMMARY*

September, 1936.

Malaya.—Imports of foreign rice during September were 50,186 tons,† and exports 15,141 tons, net imports being 35,045 tons. Net imports for the period January to September, 1936, aggregated 391,633 tons as compared with 353,470 tons in 1935.‡

Of the imports during September 50 per cent. were consigned to Singapore, 18 per cent. to Penang, 7 per cent. to Malacca, 16 per cent. to the Federated Malay States, and 9 per cent. to the Unfederated Malay States. The imports by country of origin were as follows (in tons, percentages in brackets):— Siam 33,623 (67.0); Burma 15,783 (31.4); French Indo-China 91 (0.2); and other countries 689 (1.4).

Of the September exports 64 per cent. were consigned to the Netherlands Indies, and 36 per cent. to other countries. The various kinds of rice exported were as follows (in tons, percentages in brackets):— Siam 12,163 (80.3); Burma 2,332 (15.4); French Indo-China 379 (2.5); parboiled 186 (1.2); local production 81 (0.6).

India and Burma.—Foreign exports for the first eight months of the year totalled 972,000 tons, a decrease of 26.6 per cent. compared with 1935. Of these exports 3.6 per cent. were to the United Kingdom, 17.9 per cent. to the Continent, 28.7 per cent. to Ceylon, 20.9 per cent. to the Straits Settlements and the Far East, and 28.9 per cent. to other countries. The corresponding percentages for 1935 were 4.3, 10.9, 22.8, 32.2, and 29.8.

Siam.—Exports of rice and rice products from Bangkok during July were 128,536 tons; the cumulative total for the year was 944,025 tons as compared with 883,187 tons in 1935.

Japan.—No additional information is available since the August Summary, except for the confirmation of the earlier estimate of 665,000 tons for the yield of the first Formosan rice crop, constituting a new record for Formosa.

French Indo-China.—Entries of padi into Cholon during the first nine months of the year totalled 1,275,689 tons, a decrease of 8.6 per cent. as compared with 1,395,554 tons in 1935. Exports of rice during the same period were 1,371,077 tons as compared with 1,439,382 tons in the previous year, a decrease of 4.7 per cent.

The Netherlands Indies.—The latest information available was published in the July Summary.

Ceylon.—Imports during the first nine months of 1936 totalled 398,563 tons as compared with 396,122 tons in 1935, an increase of 0.6 per cent. Of these imports 13.2 per cent. were from British India, 62.2 per cent. from Burma, 0.5

* Abridged from the Rice Summary for September, 1936, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† Tons = long tons (2,240 lbs.)

‡ It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935.

per cent. from the Straits Settlements, and 24.1 per cent. from other countries. The corresponding 1935 percentages were 12.6, 67.9, 0.9 and 18.6.

Europe and America.—Shipments from the East to Europe during the period 1st January to 10th September totalled 894,639 tons, an increase of 54.8 per cent. when compared with the 1935 shipments of 578,072 tons. Of the 1936 shipments 30 per cent. were from Burma, nil from Japan, 60.8 per cent. from Saigon, 8.2 per cent. from Siam, and 1 per cent. from Bengal. The corresponding 1935 percentages were 54.4, 4.1, 35.3, 4.4 and 1.8.

Shipments for the Levant from 1st January to 10th September aggregated 9,363 tons, as compared with 24,899 tons in 1935, a decrease of 62.4 per cent. Shipments during the same period for Cuba, West Indies and America increased by 4.4 per cent. from 177,141 tons in 1935 to 184,850 tons in 1936.

MALAYAN AGRICULTURAL EXPORTS, SEPTEMBER, 1936.

PRODUCT.	Net Exports in Tons				
	Year 1935	Jan.-Sept. 1935	Jan.-Sept. 1936	September 1935	September 1936
Arecanuts ...	21,885	16,032	21,238	1,751	881
Coconuts, fresh † ...	106,272†	78,958†	93,025†	8,714†	14,593†
Coconut oil ...	35,911	24,569	34,819	3,309	4,166
Copra ...	111,752	77,964	56,113	7,951	11,496
Gambier, all kinds ...	2,837	2,068	1,594	299	191
Oil cakes ...	11,361	7,378	11,996	1,905	1,581
Palm kernels ...	3,892	2,592	3,420	200	677
Palm oil ...	24,996	16,796	21,090	2,956	3,145
Pineapples canned ...	73,923	55,369	63,891	3,419	3,323
Rubber ¶ ...	378,381¶	292,143¶	265,159¶	27,353¶	30,430¶
Sago,—flour ...	10,920	6.510	6,602	1,763	1,075
,, —pearl ...	4,655	3.479	2,441	366	315
,, —raw ...	7,735*	5,149*	5,494*	584*	719*
Tapioca,—flake ...	1,953	1,432	1,216	151	86
,, —flour ...	755*	531*	1.402*	112*	74*
,, —pearl ...	17,169	13,019	12,864	1,508	1,255
Tuba root ...	567	430	490	33	51

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS (IN LONG TONS)

(As declared by Estates)

Month 1936	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S
January ...	1,395.4	326.5	258.6	37.2
February ...	1,531.9	372.4	244.2	54.6
March ...	1,878.4	534.5	302.9	88.0
April ...	1,410.6	446.8	250.0	80.0
May ...	1,346.1	644.8	238.1	114.6
June ...	1,557.4	658.3	245.5	100.9
July ...	2,270.5	975.7	349.1	147.6
August ..	2,963.2	1,029.0	419.2	163.0
September ..	2,671.5	969.9	394.2	136.9
Total ...	17,025.0	5,957.9	2,701.8	922.8
Total Jan. to Sept., 1935 ...	12,853.0	4,522.6	1,851.1	662.4
Total for year 1935 ...	17,338.7	5,764.6	2,711.1	818.4

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 30TH SEPTEMBER, 1936.

State or Territory	Acreage of Tappable Rubber end 1935	Estates which have entirely ceased tapping		Estates which have partly ceased tapping (a)		Area of Tappable Rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,526	400	.9	16,432	36.9	504	1.1	16,832	37.8
Malacca	121,601	5,504	4.5	29,761	24.5	2,848	2.3	35,265	29.0
Penang Island	2,575	675	26.2	499	19.4	264	10.3	1,174	45.6
Singapore Island	34,525	4,099	11.9	9,203	26.6	334	1.0	13,302	38.5
Total S.S. ...	203,227	10,678	5.3	55,895	27.5	3,950	1.9	66,573	32.8
FEDERATED MALAY STATES :—									
Perak	294,988	11,429	3.9	70,491	23.9	14,790	5.0	81,920	27.8
Selangor	332,165	11,017	3.3	66,400	20.0	14,392	4.3	77,417	23.3
Negri Sembilan	258,304	12,536	4.8	55,209	21.4	16,458	6.4	67,745	26.2
Pahang	77,210	9,237	12.0	24,716	32.0	16,415	21.3	33,953	44.0
Total F.M.S. ...	962,667	44,219	4.6	216,816	22.5	62,055	6.4	261,035	27.1
UNFEDERATED MALAY STATES :—									
Johore	432,443	32,629	7.6	61,946	14.3	38,999	9.0	94,575	21.9
Kedah	199,607	14,699	7.4	25,400	12.7	16,157	8.1	40,099	20.1
Kelantan	30,474	403	1.3	9,697	31.8	4,267	14.0	10,100	33.1
Trengganu (b)	4,643	Nil	Nil	Nil	Nil	138	3.0	Nil	Nil
Perlis (c)	1,575	Nil	Nil	761	48.3	59	3.7	761	48.3
Brunei	6,010	Nil	Nil	1,722	28.7	913	15.2	1,722	28.7
Total U.M.S. ...	674,752	47,731	7.1	99,526	14.7	60,533	9.0	147,257	21.8
TOTAL MALAYA ...	1,840,646	102,628	5.6	372,237	20.2	126,538	6.9	474,865	25.8

Notes :—(a) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(b) Registered Companies only.
(c) Rendered quarterly.

MALAYAN RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF SEPTEMBER, 1936, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
	Ports	Dealers	Estates of 100 acres and over	during the month	January to Sept. 1936	during the month	January to Sept. 1936	during the month: Foreign	during the month: From Malay States & Labuan	January to Sept. 1936: Foreign	January to Sept. 1936: From Malay States & Labuan	during the month: Foreign	during the month: Local	January to Sept. 1936: Foreign	January to Sept. 1936: Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to Sept. 1936
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES:—																				
Federated Malay States ...	...	7,362	11,725	11,003	91,018	4,177	45,341	Nil	Nil	Nil	Nil	11,429	4,833	102,090	34,715	...	5,418	12,575	12	85
Johore ...	...	2,658	3,991	4,554	37,003	3,162	27,516	Nil	110	Nil	745	2,046	6,036	19,870	44,855	...	1,876	4,517	...	...
Kedah ...	...	308	2,776	2,636	22,851	563	6,340	Nil	Nil	Nil	Nil	1,547	1,670	12,742	16,948	...	196	2,870	...	...
Perlis ...	...	12	16	13	98	10	165	Nil	Nil	Nil	Nil	Nil	23	Nil	259	...	11	17	...	...
Kelantan ...	...	266	330	315	2,597	218	4,856	Nil	Nil	Nil	Nil	114	425	1,255	6,159	...	203	387	...	...
Trengganu ...	...	55	50	230	2,028	115	1,014	Nil	Nil	Nil	Nil	Nil	345	Nil	3,042	...	55	50	...	...
Brunei ...	...	11	45	43	386	47	533	...	...	...	...	...	90	...	916	...	2	54	...	...
Total Malay States	...	10,672	18,933	18,794	155,981	8,292	85,765	Nil	110	Nil	745	15,136	13,422	135,957	106,894	...	7,761	20,470	12	85
S. SETTLEMENTS:—																				
Malacca ...	...	2,474	1,116	1,100	9,084	921	5,149	Nil		Nil		2,391		21,169		...	2,348	1,224	...	...
Province Wellesley	...	933	522	411	3,646	271	1,954	Nil		Nil		7,064	Nil	65,589	Nil	...	829	568	...	...
Penang ...	1,914	3,801	8	13	140	167	800	2,545	11,374	23,167	101,347					2,203	3,511	5	...	...
Singapore ...	5,927	16,647	169	147	1,282	297	1,212	7,470		104,400		19,519		164,972		5,999	15,223	129	34	227
Labuan ...	...	22	Nil	Nil	Nil	17	146	24		591		Nil		Nil		...	17	Nil	...	...
Total Straits Settlements ...	7,841	23,877	1,815	1,671	14,152	1,673	9,261	10,039	11,374	128,158	101,347	28,974	Nil	251,730	Nil	8,202	21,928	1,926	34	227
Total Malaya ...	7,841	34,549	20,748	20,465	170,133	9,965	95,026	10,039	11,484	128,158	102,092	44,110	13,422	387,687	106,894	8,202	29,689	22,396	46	312

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	4,694	14,541	3,275	2,855	1,487	87
WET RUBBER	724	682	236	341	339	109
TOTAL ...	5,418	15,223	3,511	3,196	1,876	196

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to Sept. 1936
29	30	31
Singapore ...	28,764	245,065
Penang ...	10,474	95,103
Port Swettenham.	4,631	44,302
Malacca ...	241	3,217
MALAYA ...	44,110	387,687

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to Sept. 1936
32	33	34
Malay States ...	28,558	242,851
Straits Settlements	3,218	22,430
MALAYA ...	31,776	265,281

Notes:—
1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23rd October, 1936.

METEOROLOGICAL SUMMARY, MALAYA, SEPTEMBER, 1936.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of		Mean of A and B.	Absolute Extremes				At 1 foot	At 4 feet	Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.		Highest Max.	Lowest Min.	Lowest Max.	Highest Min.					Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	91.2	71.5	81.3	95	68	85	74	83.9	84.7	8.18	207.8	1.68	21	18	4	2	1	172.05	5.73	47
Bukit Jeram, Selangor ...	89.0	72.1	80.5	93	69	86	75	84.3	86.1	2.86	72.7	0.85	17	15	2		1	201.10	6.70	55
Sitiawan, Perak ...	89.2	73.2	81.2	92	71	86	77	84.1	84.8	5.84	148.3	2.39	14	10				178.10	5.94	49
Temerloh, Pahang ...	90.0	72.0	81.0	92	69	87	75	86.1	86.3	7.11	180.6	2.51	16	10	4	11		196.95	6.57	54
Kuala Lipis, Pahang ...	89.4	71.3	80.3	92	68	86	75	83.9	84.9	6.14	156.0	1.38	12	9	3	20		165.55	5.52	46
Kuala Pahang, Pahang ...	88.1	74.1	81.1	90	72	86	76	87.9	87.6	1.93	49.0	1.06	9	5				243.90	8.13	67
Kallang Aerodrome, S'pore ...	85.8	76.0	80.9	89	73	82	80	82.7	84.1	5.85	148.6	2.25	15	11	2			201.55	6.72	55
Butterworth, Province Wellesley ...	86.9	73.9	80.4	90	70	79	77	84.4	85.6	10.56	268.2	4.86	22	17	2			177.40	5.91	49
Bayan Lepas Aerodrome Penang ...	86.4	73.9	80.1	90	71	79	77	83.7	84.4	17.56	446.0	7.46	19	17	2			171.25	5.71	48
Bukit China, Malacca ...	85.1	73.6	79.3	87	70	82	76	83.8	84.1	6.35	161.3	2.91	15	12	3	1	1	191.25	6.37	53
Kluang, Johore ...	88.2	70.4	79.3	91	67	84	74	81.5	82.2	6.87	174.5	2.40	16	11	8	12	1	168.20	5.61	46
Bukit Lalang, Mersing, Johore	87.4	71.2	79.3	91	69	85	74	81.9	82.0	5.43	137.9	1.32	16	13	5		2	208.40	6.95	57
Alor Star, Kedah ...	86.9	74.0	80.5	91	71	79	77	83.3	83.9	12.82	325.6	3.00	24	20				175.85	5.86	48
Kota Bahru, Kelantan ...	89.4	73.6	81.5	91	72	85	76	85.5	85.4	5.15	130.8	0.87	12	11	3			199.55	6.65	54
Kuala Trengganu, Trengganu	88.4	73.1	80.7	91	71	85	75	83.7	84.7	4.95	125.7	1.13	12	9	3			197.90	6.60	55
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	75.5	62.2	68.9	79	60	70	65	72.3	72.7	6.16	156.5	1.29	15	12		4		181.85	6.06	50
Cameron Highlands. Tanah Rata, Pahang 4750 ft. ...	72.5	56.7	64.6	76	52	65	62	70.7	70.3	10.24	260.1	1.74	23	19	3	2		117.05	3.90	32
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.8	59.2	65.5	76	57	65	61			9.45	240.0	1.49	23	18	3	2		133.95	4.47	37

Compiled from Returns supplied by the Meteorological Branch, Malaya.

The publications of the Department of Agriculture, S.S. and F.M.S. are issued in two series:—

(*a*) The Malayan Agricultural Journal, monthly at 50 cents per copy, or post free $5/- per annum.

(*b*) Special Bulletins, at irregular intervals. Price varies with the cost of production. It is anticipated that from six to eight will be published annually. Subscription $5/- per annum.

Thus, all the English publications of the Department may be obtained post free for $10/- per annum.

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NOTICE.

Department of Agriculture, S.S. and F.M.S.

The Adviser on Agriculture invites those interested to visit the Central Experiment Station and the School of Agriculture, Serdang, and also the other Experiment Stations, Agricultural Stations, Farm Schools, Padi Experiment Stations, and Padi Test Stations of the Department in various parts of the Straits Settlements and Federated Malay States.

Agricultural Stations and Padi Test Stations also exist in certain of the Unfederated Malay States, to which visits are welcomed by the State authorities.

Intending visitors to the Central Experiment Station should communicate with the Senior Assistant Agriculturist in charge, and to the School of Agriculture with the Principal.

The Central Experiment Station and the School of Agriculture are situated about fourteen miles by road from Kuala Lumpur and three miles from Serdang Railway Station where cars can be hired. Visitors' days at the Experiment Station are the first and third Wednesdays in each month.

Other Stations are listed below together with the addresses of officers to whom enquiries should be sent.

Experiment Station, Tanah Rata, *Agricultural Officer, Cameron Highlands.*

Coconut Experiment Station, Port Swettenham, *The Agriculturist, Department of Agriculture, Kuala Lumpur.*

Pineapple Experiment Station, Lim Chu Kang, Singapore, *Agricultural Officer, Singapore.*

Titi Serong Padi Experiment Station, *Agricultural Officer, Krian.*

Talang Padi Experiment Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*

Pulau Gadong Padi Experiment Station, *Agricultural Officer, Malacca.*

Dairy Farm, Fraser's Hill, *Manager.*

Bukit Mertajam Agricultural Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Selama Agricultural Station, *Agricultural Officer, Krian.*

Kuala Kangsar Agricultural Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*

Cheras Agricultural Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*

Rembau Agricultural Station, *State Agricultural Officer, Negri Sembilan, Seremban.*

Kuala Pilah Agricultural Station, *State Agricultural Officer, Negri Sembilan, Seremban.*

Sungei Udang Agricultural Station, Farm School, and Padi Test Station, *Agricultural Officer, Malacca.*

Kuala Lipis Agricultural Station, *State Agricultural Officer, Pahang, Kuala Lipis.*

Temerloh Agricultural Station, *Malay Agricultural Officer, Pahang South, Temerloh.*

Kuantan Agricultural Station, *Malay Agricultural Officer, Pahang East, Pekan.*

Pekan Agricultural Station and Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*

Ayer Itam Agricultural Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Raub Agricultural Station, *State Agricultural Officer, Pahang, Raub.*

Telok Datoh Agricultural Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*

Labuan Agricultural Station and Padi Test Station, *Agricultural Officer, Singapore.*

Kuala Kurau Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Bagan Serai Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Briah Padi Test Station, *Agricultural Officer, Krian, Parit Buntar.*
Selinsing Padi Test Station, *Agricultural Officer, Parit Buntar.*
Bukit Gantang Padi Test Station, *State Agricultural Officer, Perak, Taiping.*
Lenggong Padi Test Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*
Bruas Padi Test Station, *Agricultural Officer, Perak Central, Kuala Kangsar.*
Sungei Manik Padi Test Station, *Agricultural Officer, Perak South, Teluk Anson.*
Panchang Bedena Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Sungei Haji Durani Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Tanjong Karang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kuang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kajang Padi Test Station, *State Agricultural Officer, Selangor, Kuala Lumpur.*
Kuala Klawang Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
Ampang Tinggi Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
Kendong Padi Test Station, *State Agricultural Officer, Negri Sembilan, Seremban.*
Dong Padi Test Station, *State Agricultural Officer, Pahang, Raub.*
Kuala Lipis Padi Test Station, *State Agricultural Officer, Pahang, Raub.*
Kerdau Padi Test Station, *Malay Agricultural Officer, Pahang South, Temerloh.*
Bawang Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
Pekan Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
Sungei Blat Padi Test Station, *Malay Agricultural Officer, Pahang East, Pekan.*
Glugor Padi Test Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*
Bukit Merah Padi Test Station, *Agricultural Officer, Province Wellesley & Penang, Butterworth.*

Unfederated Malay States.

Central Experiment Station, Ayer Hitam, Johore, *Agricultural Officer, Johore Central, Kluang.*
Tangkah Agricultural Station, *Agricultural Officer, Johore North, Muar.*
Gaja Mati Agricultural Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Central Experiment Station, Kota Bharu, Kelantan, *State Agricultural Officer, Kelantan, Kota Bharu.*
Kilanas Agricultural Station and Padi Test Station, Brunei, *Agricultural Officer, Singapore.*
Tangkah Padi Test Station, *Agricultural Officer, Johore North, Muar.*
Jimentah Padi Test Station, *Agricultural Officer, Johore North, Muar.*
Tenglu Padi Test Station, *Agricultural Officer, Johore Central, Kluang.*
Telok Chengai Padi Experiment Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Langgar Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Jitra Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Rantau Panjang Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Pulai Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Sala Kanan Padi Test Station, *Principal Agricultural Officer, Kedah, Alor Star.*
Pasir Puteh Padi Test Station, *State Agricultural Officer, Kelantan, Kota Bharu.*
Seriab Padi Test Station, *Adviser, Perlis, Kangar.*
Kampong Salang Padi Test Station, *Adviser, Perlis, Kangar.*
Lumapas Padi Test Station, Brunei, *Agricultural Officer, Singapore.*

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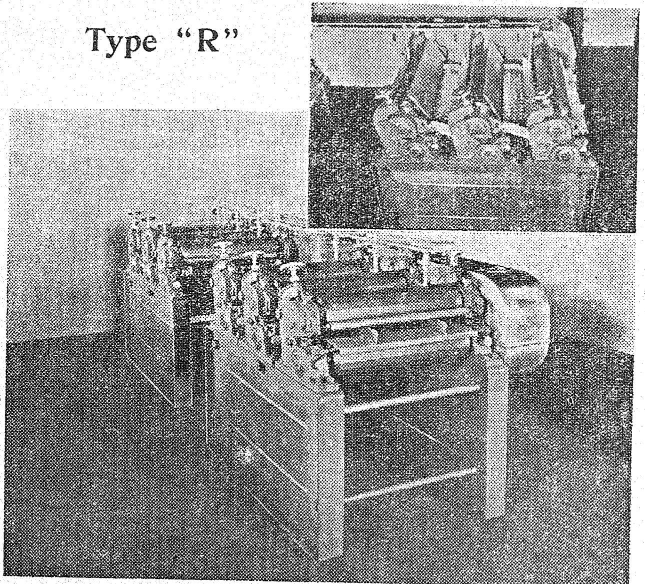

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THE

Malayan Agricultural Journal.

DECEMBER, 1936.

EDITORIAL.

Experiments with Padi.

In accordance with the established custom of devoting one number of the Journal annually to padi, in the present number we offer accounts of the selection and varietal trials and the manurial and cultural experiments on padi which have been carried out by the Department of Agriculture during the season 1935-36.

This season was an unfortunate one for varietal trials, as climatic conditions were far from ideal, and pests, such as stem-borers, birds and rats, caused damage which, to a great extent rendered it impossible to obtain reliable results on many of the Stations and Plots. We include, however, for purposes of record, figures for trials of various strains grown on Plots on which unsatisfactory results were obtained, but, it is emphasised that, in such cases, they do not represent the true capabilities of the given strains in these localities.

Nowhere have such new and striking results been obtained as would suggest that well established strains will be ousted by the more recent selections.

Field trial plots were laid down in the Krian District on land owned and worked by local headmen. These showed that Siam 29, a strain which, on the results of varietal trials on Departmental Test Plots, was considered to be the most suitable for the south-east portion of the District, had certain defects when planted on a large scale in this area. On the other hand, these plots confirmed the finding that Seraup Kechil 48 was fully suitable to the soft soil and deep water conditions of the north-west portion of the District and might even prove to be the best strain for the south-east area. These results show the desirability of supplementing the work on Departmental Test Plots with trials conducted by cultivators themselves before accepting any particular strain for widespread distribution.

In some parts of the country, pure strains appear to give more definite increases of yield as compared with local varieties, than in other parts, and have, in consequence, attained more popularity. In Malacca, for example, the demand for seed of the best selected strain of Siam and Nachin, which are becoming well-known locally, was considerably in excess of the supplies available on the two Government Stations, and the seed distributed amounted to well over 4,000 gantangs.

Regarding manurial trials, the most important point to which we wish to draw the attention of our readers is that, in places where phosphatic fertilizers are effective, cheap rock phosphate dust was proved as efficient as the more expensive fertilizers, and should give profitable increases of yield if it can be distributed at prices not exceeding \$1.60 to \$1.80 per cwt. in such districts.

Original Articles.

PADI SELECTION AND VARIETAL TRIALS 1935-1936

Compiled by
B. A. Lowe,
Rice Research Botanist.

Introduction.

This report, which is laid out on lines similar to those followed previously,* summarizes the results of padi varietal trials and selection work carried out by the Department of Agriculture during the 1935-36 season. As in former years, close co-operation in this work has been maintained between the Research and the Field Branches of the Department, the former being responsible for advice on the lay-out of experiments and analysis of results, and the latter for the actual carrying out of the experiments.

During the year under review, five main Experiment Stations and forty-three Test Plots were maintained, an increase of 17 Test Plots over the 1934-35 total. The new Test Plots include three in Johore, one in Perak and four in Brunei on which standard varietal trials were not laid down. New Test Plots on which varietal trials were laid down include two in Kedah, two in Perak, one in Negri Sembilan and one in Pahang. One Test Plot in Perak (Sungei Tontong, formerly in the Dindings) was abandoned owing to unsuitable conditions. The list on the next page shows the Test Plots and Stations utilized during the season under review.

Results from Experiment Stations and Test Plots in Unfederated States are included by courtesy of the Governments concerned.

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* See *Malayan Agricultural Journal*, Vol. XXIV, No. 2, February, 1936.

Note.—The gantang, which is the common local measure for padi, equals one Imperial gallon. One gantang of padi weighs approximately 5½ lbs.
One kati = 1 1/3 lbs.

Abbreviations used in the report are as follows:—

S.D.—Standard Deviation.

M.S.D.—Minimum Significant Difference between any two varietal means.

Bj.	— Bujang	R.C.	— Radin China
Ch.	— Chubai	R.C.N.	— Radin Che Nah
F.S.	— Foundation Stock	R.S.	— Radin Siak
H.	— Hybrid	Rey.	— Reyong
M.E.	— Mayang Ebus	Sm.	— Siam
M.K.	— Mayang Kuning	S.M.	— Serbok Mas
Mk.K.	— Milek Kuning	S.B.	— Seraup Besar
Mk.P.	— Milek Puteh	S.K.	— Seraup Kechil
N.	— Nachin	Ser.	— Serendah
R.	— Radin		

Distribution of Experiment Stations and Test Plots 1935-36.

State.	Name of Station or Test Plot.	Locality.	Notes.
Perlis	Seriab	Kangar	
„	Kampong Salang	„	
Kedah	Telok Chengai Experiment Station	Alor Star	
„	Langgar	Kota Star North	
„	Jitra	Kubang Pasu	
„	Sala Kanan	Kota Star South	Test Plot in new locality
„	Rantau Panjang	Kuala Muda	
„	Pulai	Baling	
„	Langkawi	Langkawi Island	New Test Plot.
Penang	Glugor	South-West District	
P. Wellesley	Bukit Merah	Central District	
Perak	Titi Serong Experiment Station	Krian	
„	Kuala Kurau	„	
„	Bagan Serai	„	
„	Briah	„	
„	Kampong Kedah	„	New Test Plot.
„	Sungei Kepar	„	„
„	Selinsing	„	
„	Bukit Gantang	Larut	
„	Lenggong	Upper Perak	
„	Bruas	Bruas	
„	Talang Experiment Station	Kuala Kangsar	
„	Sungei Manik	Lower Perak	New Test Plot.
Selangor	Panchang Bedena	Kuala Selangor	
„	Sungei Haji Durani	„ „	
„	Tanjong Karang	„ „	
„	Kuang	Ulu Selangor	
„	Kajang	Ulu Langat	
N. Sembilan	Kuala Klawang	Jelebu	
„	Ampang Tinggi	Kuala Pilah	New Test Plot.
„	Kendong	Tampin	
Malacca	Pulau Gadong Experiment Station	Central District	
Johore	Tangkak	Muar	New Test Plot.
„	Tenglu	Endau	„
„	Jementah	Segamat	„
Pahang	Kuala Lipis	Kuala Lipis	
„	Dong	Raub	
„	Temerloh	Temerloh	Abandoned at close of season.
„	Sungei Blat	Kuantan	
„	Bawang	Pekan	New Test Plot.
„	Pekan	Pekan	„
Kelantan	Central Experiment Station	Kota Bahru	
„	Pasir Puteh	Pasir Puteh	
Brunei	Kilanas	Kilanas	
„	Berakas	Berakas	New Test Plot.
„	Kuala Abang	Tutong	„
„	Lumapas	Lumapas	„
Labuan	Bukit Kallam	Bukit Kallam	„

As formerly, a standard Latin Square, arranged as shown below, was used (except where otherwise stated) and minimum significant differences between any two varieties are estimated on a basis of Fisher's 't' test for 5 per cent. points.

Standard Lay-out.

4-way Square.

A	D	B	C
D	C	A	B
C	B	D	A
B	A	C	D

5-way Square.

D	E	C	B	A
B	D	E	A	C
C	A	B	D	E
A	C	D	E	B
E	B	A	C	D

PERLIS.

The two Test Plots at Kampong Salang and Seriab were maintained under the supervision of the Principal Agricultural Officer, Kedah, and the Malay Padi Inspector, Perlis. On each Plot, randomized blocks with sub-plots of 1/45th acre were laid down. As the lay-out was unsatisfacory for statistical treatments of results, mean yields obtained from each variety are shown below, together with the number (in brackets following the varietal name) of sub-plots from which the mean was calculated.

Table I.

Seriab.			Kampong Salang.		
Variety.		Mean Yield per 1/45th acre in gantangs.	Variety.		Mean Yield per 1/45th acre in gantangs.
Sm. 29	(6)	17.4	Sm. 29	(4)	14.7
Rey. 20	(5)	10.9	Rey. 20	(4)	12.5
To 'Awang	(4)	14.8	Radin Pulau	(4)	10.7
N. 10	(5)	14.4	N. 10	(3)	14.3
Sm. 76	(6)	14.2	Sm. 76	(4)	11.9
M.E. (Local)	(4)	11.3	M.E. 88	(4)	7.7
Mean		13.8	Mean		12.0

KEDAH.

The Test Plot at Sala Kanan, abandoned the previous season owing to difficulties of water control, was re-opened on a different and more satisfactory site. In addition, a new Plot was opened at Ulu Malacca on Langkawi Island. The site of this Plot is sufficiently large to accommodate one four-way Latin Square with 1/60th acre sub-plots on the sandy soil typical of the padi areas on Langkawi.

Telok Chengai Experiment Station.

Selection.—The selection of the variety To'Seman, commenced in the season 1933-34, was continued, 49 lines being grown. These were reduced during the 1935-36 season by the discarding of 31, leaving 18 for further selection and trial.

The 5 to 5½ month varieties Nakon and Kala, locally popular as excellent eating and milling varieties, were grown in lines, 100 of the former and 50 of the latter. Forty-six lines of Nakon and seventeen of Kala were discarded as being inferior.

Selection of the Indian variety Kalyaman was not carried out as had been intended owing to poor germination of seed. Two small plots of plants were grown, however, and ears chosen for ear-to-row comparisons during the forthcoming season.

No varietal trials were held on the Station. The yields from multiplication plots are recorded in Table II, which also shows yields calculated from samples of 1/120th acre for comparison. It will be noted that Siam 29 and Radin China 4 again gave the highest yields.

Table II.

Variety.	Area (acres)	Actual Yield per acre. gantangs	Yield per acre calculated from sample plots of 1/120th acre. gantangs	Yield per acre 1934-35 season. gantangs
R.C. 4 ...	3.22	563	614	632
Sm. 29 ...	2.55	608	606	563
Rey. 20 ...	2.08	534	592	536
Sm. 76 ...	3.11	548	553	553
R.C.N. 28 ...	0.44	560	535	546
M.E. 80 ...	2.19	495	533	—
M.E. 88 ...	3.42	480	515	461
R.C. 17 ...	2.46	506	508	—
S.K. 48 ...	0.67	430	495	533
Ch. 18 ...	2.49	528	481	514
N. 10 ...	0.79	551	480	508
S.B. 15 ...	0.62	445	465	445

Note.—All manured with local guano at rate of 100 gantangs per acre one month after transplanting.

Langgar Padi Test Plot.

A four-way Latin Square was laid down on the land occupied by the five-way Square during the previous season, the varieties being the same as used in the previous four-way Square with the substitution of Reyong 20 for Radin Siak 7. Yields were lower than in the 1934-35 season, probably partly due to unfavourable weather and lodging at harvest. Table III below shows the results obtained. Yields of the four varieties are remarkably uniform and show no significant differences.

The remainder of the Test Plot was occupied by randomized blocks, replicated four times and laid down primarily for multiplication. Table IV records the mean yields, between which were no significant differences.

The whole Test Plot was manured with bat guano at the rate of 100 gantangs per acre, one month after transplanting.

Table III.

	Sm. 76	Rey. 20	Sm. 29	N. 10	Mean
Mean Yield per 1/120th acre lbs.	18.9	19.4	19.4	19.9	19.4

Table IV.

	Sm. 29	Rey. 20	Sm. 76	N. 10	Mean
Mean Yield per 1/45th acre lbs.	50.0	49.6	53.2	51.4	51.0

Jitra Padi Test Plot.

At this Test Plot, one four-way Latin Square was laid down, the remaining area being used for multiplication of varieties which were transplanted as four randomized blocks. As the land was manured the previous season, no manure was applied during the season under review. The crop suffered no loss by rats or flooding, though unfavourable weather at harvest reduced yields to some extent.

Table V shows the results of the Latin Square and of the randomized blocks.

Sala Kanan Padi Test Plot.

As this Station was opened on a new site for the 1935-36 season, some of the bunds were not properly consolidated, thus causing loss and consequent shortage of water. Rat damage also occurred and grain was lost during unfavourable weather at harvest. Nevertheless yields were not unsatisfactory. One four-way

Table V.

Latin Square.		Randomized Block	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/45th acre in lbs.
M.E. 88 ...	35.0	R.C. 4 ...	67.8
R.C. 4 ...	34.8	M.E. 88 ...	74.6
R.C. 17 ...	35.1	M.E. 80 ...	82.5
M.E. 80 ...	38.2	R.C. 17 ...	70.3
		Sm. 76 ...	78.0
Mean	35.8	Rey. 6 ...	77.0
S.D. 1.09 lbs. (2.9% of mean) M.S.D. 1.8 lbs.		Mean	75.0
		S.D. 7.35 lbs. (9.8% of mean) M.S.D. 12.7 lbs.	

Latin Square with 1/90th acre sub-plots was laid down, and the rest of the Station planted with varieties for multiplication purposes. Table VI records the results of the Latin Square experiment and mean yields of the multiplication plots.

Table VI.

Latin Square.		Multiplication Plots	
Variety.	Mean Yield per 1/90th acre in lbs.	Variety.	Mean Yield per 1/45th acre in lbs.
M.E. 88 ...	47.2	M.E. 88 ...	66.6
R.C. 17 ...	48.9	R.C. 17 ...	63.7
M.E. 80 ...	51.7	M.E. 80 ...	61.6
R.C. 4 ...	50.5	R.C. 4 ...	73.8
		Rey. 20 ...	72.4
Mean	49.6	S.K. 48 ...	65.5
S.D. 3.49 lbs. (7.0% of mean) M.S.D. 6.1 lbs.		Mean	67.2

Rantau Panjang Padi Test Plot.

The five-way Latin Square laid down at this Plot had to be modified to fit into a space with a bund in the centre. In addition to the Latin Square five replicated randomized blocks were planted for multiplication purposes. No manure was applied to the Test Plot.

Table VII shows yields recorded.

Table VII.

Latin Square	
Variety.	Mean Yield per 1/120th acre in lbs.
N. 10 ...	34.6
Sm. 29 ...	32.6
Rey. 20 ...	32.7
Sm. 76 ...	32.5
R.C. 4 ...	35.3
Mean	33.5
S.D. 1.95 lbs. (5.8% of mean) M.S.D. 2.8 lbs.	

Randomized Multiplication Block	
Variety.	Mean Yield per 1/45th acre in lbs.
N. 10 ...	72.6
Sm. 29 ...	70.3
Rey. 20 ...	73.7
Sm. 76 ...	64.8
R.C. 4 ...	70.3
Anak Kuching	61.9
Mean	69.1
S.D. 7.24 lbs. (10.4% of mean) M.S.D. 10.6 lbs.	

Pulai Padi Test Plot.

A modified five-way Latin Square and duplicated randomized blocks were laid down at this Test Plot. Planting was delayed owing to water shortage but this did not affect yields. No manures were applied.

Reyong 20, maturing earlier than other varieties, suffered severely from birds and rats. Siam 29 and Siam 76 again gave high yields.

Results are shown in Table VIII.

Langkawi Padi Test Plot.

This new Plot, opened for the first time in 1936 accommodated one four-way Latin Square, the results of which are shown in Table IX.

No manure was applied. The yields of Siam 29 and Nachin 10 compare favourably with average yields (800 to 1,100 lbs. per acre) of local varieties in Langkawi.

Table VIII.

Latin Square.		Randomized Multiplication Plots.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/45th acre in lbs.
Sm. 29 ...	42.5	Sm. 29 ...	71.6
Sm. 76 ...	39.1	Sm. 76 ...	75.0
Serendah (local)	40.2	Serendah (local)	83.0
N. 10 ...	35.2	N. 10 ...	69.5
Rey. 20 ...	28.0	Rey. 20 ...	70.1
Mean	36.6	Mean	73.8
S.D. 5.47 lbs. (14.9% of mean) M.S.D. 8.0 lbs.			

Table IX.

Variety.	Mean Yield per 1/60th acre in lbs.
R.S. 7 ...	18.9
Sm. 29 ...	25.7
N. 10 ...	25.2
Puteh Meliyau (local) ...	19.2
Mean	22.3
S.D. 1.09 lbs. (4.9% of mean) M.S.D. 1.9 lbs.	

PENANG AND PROVINCE WELLESLEY.

Glugor Padi Test Plot (Penang).

Stem-borers and rats were responsible for extensive damage to all four Latin Squares on this Test Plot. The results are thus of little value. It is reported that in Square A, Seraup Kechil 146 escaped rat damage and in Square C, Nachin 756 was more severely attacked by rats than other varieties. Flood damage, usually experienced on this Plot was not reported during the season under review.

Yields together with means are recorded in Table X.

Table X.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
S.K. 36 ...	6.5	Sm. 29 ...	4.0
S.K. 48 ...	8.7	R. 2 ...	3.3
Sebatil ...	9.5	R. 4 ...	6.4
S.K. 146 ...	17.4	N. 66 ...	5.5
Mean	10.5	Mean	4.8
Square C.		**Square D.**	
Ser. 824 ...	9.8	Sm. 29 ...	10.5
M.E. 203 ...	6.0	R.S. 18 ...	12.4
N. 756 ...	3.2	R.S. 17 ...	10.5
M.E. 202 ...	6.9	R.S. 34 ...	7.7
Mean	6.5	Mean	10.3

Bukit Merah Padi Test Plot (Province Wellesley).

Shortly before harvest, fairly serious and general lodging occurred with consequent loss of grain. The performance of Siam 29 and Mayang Ebus 203 particularly of the latter, the two best strains of previous years, was again satisfactory.

Results are recorded in Table XI.

Table XI.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
Rey. 20 ...	9.7	Sm. 29 ...	10.5
R.C. 4 ...	10.7	N. 66 ...	12.0
Rey. 6 ...	12.0	Ser. 824 ...	9.6
Rey. (local) ...	8.7	N. 756 ...	8.9
Mean	10.3	Mean	10.2
S.D. 0.82 lbs. (7.9% of mean) M.S.D. 1.4 lbs.		S.D. 0.76 lbs. (7.4% of mean) M.S.D. 1.3 lbs.	

Square C.		Square D.	
Sm. 29 ...	10.1	Sm. 29 ...	11.9
N. 66 ...	11.2	N. 66 ...	10.1
M.E. 203 ...	10.8	M.E. 80 ...	12.4
F. 63 ...	10.0	M.P. 148 ...	12.7
Mean	10.5	Mean	11.8
S.D. 0.65 lb. (6.2% of mean) M.S.D. 1.1 lbs.		S.D. 1.81 lbs. (15.4% of mean) M.S.D. 3.2 lbs.	

Table XI (*Contd.*)

Square E.	
Variety.	Mean Yield per 1/120th acre in lbs.
M.E. 203 ...	13.1
M.E. 210 ...	13.0
M.E. 88 ...	11.8
M.E. 80 ...	12.8
Mayang (local) ...	11.7
Mean	12.5

S.D. 1.06 lbs. (8.5% of mean)
M.S.D. 1.5 lbs.

PERAK.

Titi Serong Experiment Station.

Only a fair season was experienced at this Station. From late October to January there was an excess of water, and the Station could not be properly dried out at harvest. Rat damage generally was severe, but, with the exception of the Mayang Ebus Square, the Latin Squares were not badly attacked.

Pure Line Selections.—Fifteen long maturation and twelve medium maturation strains were grown during the season. Of the Seraups, Seraup Kechil 146 and 371 were again satisfactory, while Seraup Kechil 48 suffered severe rat damage. The Bujangs gave even yields but were finally discarded. Two of the old Foundation Stock lines (F.S. 42 and 48) together with Radins 4, 7, 11 and13 were satisfactory and are being maintained. The Mayang Ebus strains were disappointing and only Mayang Ebus 203 is being maintained. It is intended to introduce the Kedah selection Mayang Ebus 88 next season. Pahit, Mayang Kuning 48 and Machang 42 are being maintained.

In the ear-to-row selection now in progress, a system was introduced whereby three rows of a proved line are grown with each line under trial for comparison. This facilitated selection and will be continued.

Of the Serbok Mas lines, Serbok Mas 4 proved the best, but, as the type does not possess great potentialities, all were discarded.

Four of the eleven lines of Tongkat were discarded on the combined results of this and the previous season, leaving a balance of seven lines for further observation.

Rat damage caused difficulty in selecting the best of the ten Machang lines and only two were discarded.

Fifteen lines of Mayang Sa'Batil from Glugor did very well and are promising. Twelve lines were retained for further trial.

Thirty-three lines of Mayang Ebus from Bukit Merah Test Plot suffered severely from rat damage and from a season which apparently was unfavourable to them. Twenty-two lines are being retained and moved to Briah Test Plot, where conditions will probably be more to their liking.

Hybrids.—Making allowance for the somewhat unfavourable season, the hybrid lines (now in the fifth generation) were disappointing. Of the twenty-two lines, all were discarded except four of the hybrid Radin 2 x Seraup Kechil 36.

Varietal Trials.—The varietal trials consisted of three five-way and two four-way Latin Squares. In Square A, Seraup Kechil 146 and 371 proved the best, though not significantly better than Mayang Kuning 48. Squares C and D were used for comparison of Mayang Ebus strains. The season was reported as unfavourable to these strains and rat damage was severe. In Square E, no significant differences appeared between the Bujangs though all exceeded Seraup Kechil 48. The weak straw of the Bujangs limits their utility and in general they are better replaced by the stronger Seraup Besar 15 which they resemble. Results are shown below in Table XII.

Table XII.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
S.K. 48 ...	17.1	R. 1 ...	12.6
S.K. 68 ...	21.5	R. 4 ...	19.0
S.K. 146 ...	27.0	R. 7 ...	17.8
S.K. 371 ...	26.0	R. 11 ...	18.0
M.K. 48 ...	23.6	R. 13 ...	20.2
Mean	23.5	Mean	17.5
S.D. 2.84 lbs. (11.5% of mean) M.S.D. 4.1 lbs.		S.D. 2.02 lbs. (11.5% of mean) M.S.D. 2.9 lbs.	

Table XII (*Contd.*)

Square C.		Square D.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
M.E. 202 ...	16.1	M.E. 202 ...	14.0
M.E. 203 ...	14.6	M.E. 203 ...	13.5
M.E. 208 ...	14.4	M.E. 208 ...	12.9
M.E. 210 ...	14.1	M.E. 210 ...	12.9
Mean	14.6	Mean	13.3
S.D. 1.6 lbs. (7.5% of mean) M.S.D. 2.8 lbs.		S.D. 1.42 lbs. (9.3% of mean) M.S.D. 2.5 lbs.	

Squares C. & D. combined		Square D.	
M.E. 202 ...	15.1	Bj. 211 ...	21.1
M.E. 203 ...	14.1	Bj. 213 ...	21.6
M.E. 208 ...	13.6	Bj. 215 ...	21.1
M.E. 210 ...	13.5	Bj. 216 ...	21.7
		S.K. 48 ...	18.0
Mean	14.1	Mean	20.7
S.D. 1.52 lbs. (10.8% of mean) M.S.D. 1.7 lbs.		S.D. 0.91 lb. (4.4% of mean) M.S.D. 1.3 lbs.	

Kuala Kurau Padi Test Plot.

Growing conditions during the season, while not ideal, were satisfactory, and an excellent crop, equal to that of the previous season, was reaped. The yield trial consisted of a duplicated four-way Latin Square containing three Seraups and a Machang. While Seraup Kechil 146 was the best in both squares it was not significantly better than the second best variety which in one square was the unselected local Machang. In view of the superiority of Seraup Kechil 48 at this Station in the previous season, there still seems to be some doubt as to which is the best of these strains for local planting.

The results are shown in Table XIII.

Table XIII.

Variety.	Mean Yield per 1/120th acre in lbs.		
	Square A.	Square B.	Squares A & B combined.
S.K. 48 ...	29.1	30.8 ...	29.9
S.K. 146 ...	37.3	36.7 ...	37.0
S.K. 371 ...	32.4	34.4 ...	33.4
Machang (local) ...	33.7	32.8 ...	33.3
Mean ...	33.1	33.7 ...	33.4
S.D. ...	2.5 lbs.	1.4 lbs. ...	2.1 lbs.
S.D. as percentage of mean	7.5	4.1 ...	6.3
M.S.D. ...	4.3 lbs.	2.5 lbs. ...	3.6 lbs.

Table XIV.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
S.K. 36 ...	15.2	R. 4 ...	18.3
S.K. 48 ...	16.5	R. 7 ...	18.7
S.K. 146 ...	16.3	R. 11 ...	18.7
S.K. 371 ...	16.4	R. 13 ...	18.5
Serendah (local)	17.2	M.E. 203 ...	13.6
Mean ...	16.3	Mean	17.6
S.D. ...	1.28 lbs.	Not analysed.	
S.D. as percentage of mean	8.0		
M.S.D. ...	1.9		

Bagan Serai Padi Test Plot.

Apart from the difficulty of reducing water level towards the end of the season, this Plot was satisfactory. Yields, however, did not fulfil the promise which is said to have been shown in their vegetative growth. Two Latin Squares were laid down and results from them are shown in Table XIV. The local unselected Serendah proved better than the Seraups, but only significantly so in the case of S.K. 36.

Briah Padi Test Plot.

The season at this Plot was satisfactory in spite of reported heavier rat damage than usual and a slight attack of *Nymphula* in the nurseries. The Kedah variety, Reyong 20, while making vigorous growth, was disappointing in yield; in Square C rats showed a preference for this variety. Mayang Ebus 88 was sufficiently satisfactory to warrant further trial.

Results of the Latin Squares are recorded in Table XV.

Table XV.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
S.K. 48 ...	13.6	Sm. 29 ...	19.7
S.K. 68 ...	13.4	Sm. 76 ...	19.0
S.K. 146 ...	14.2	M.E. 88 ...	16.8
S.K. 371 ...	15.1	M.E. 203 ...	16.1
		Rey. 20 ...	13.0
Mean	14.1	Mean	16.9
S.D. 0.87 lb. (6.2% of mean) M.S.D. 1.5 lbs.		S.D. 1.54 lbs. (9.1% of mean) M.S.D. 2.25 lbs.	

Table XV (*Contd.*)

Square C.		Squares B. & C. combined.
Variety.	Mean Yield per 1/120th acre in lbs.	Mean Yield per 1/120th acre in lbs.
Sm. 29 ...	17.7	18.7
Sm. 76 ...	18.3	18.6
M.E. 88 ...	15.7	16.2
M.E. 203 ...	14.5	15.3
Rey. 20 ...	14.3	13.6
Mean	16.1	Mean 16.5
S.D. 2.05 lbs. (2.7% of mean) M.S.D. 3.0 lbs.		S.D. 1.81 lbs. (10.9% of mean) M.S.D. 1.7 lbs.

Selinsing Padi Test Plot.

The crop at this Plot received a severe set back from lack of water early in the season; consequently growth was uneven. Further losses of grain were experienced through lodging which occurred some time before harvest. Pest damage was negligible. Of standard varieties all the Seraups and Mayang Ebus 88 did well. The Siams were satisfactory but Siam 29 lodged almost completely.

Table XVI.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
S.K. 48 ...	14.0	Sm. 29 ...	12.6
S.K. 68 ...	13.6	Sm. 76 ...	13.1
S.K. 148 ...	14.4	M.E. 88 ...	13.6
S.K. 371 ...	15.0	M.E. 203 ...	10.3
Mean	14.2	Rey. 20 ...	12.1
S.D. 1.19 lbs. (8.4% of mean) M.S.D. 2.1 lbs.		Mean	12.3
		S.D. 1.38 lbs. (11.2% of mean) M.S.D. 2.0 lbs.	

Table XVI (*Contd.*)

Square C.	
Variety.	Mean Yield per 1/120th acre in lbs.
Sm. 29 ...	14.0
Radin Kuning ...	14.8
Dok Dik ...	13.5
Radin Che Mah	12.8
Radin Puteh ...	13.5
Mean	13.7

S.D. 1.78 lbs. (12.9% of mean)
M.S.D. 2.6 lbs.

Square C was laid down to test local unselected varieties, using Siam 29 as a standard. Dok Dik appears to be of Seraup type. Radin Che Mah is a rather small-grained white Radin with many purple tips and Radin Puteh closely resembles the strains Radin 11 and 16. With the exception of Radin Che Mah, the local strains appeared to be as good as Siam 29 and superior in straw characters.

The results are shown in Table XVI.

Sungei Kepar Padi Test Plot.

This Plot was opened at the beginning of the 1935-36 season. In spite of lack of water early, and excess, together with difficulty in draining later, yields were satisfactory. The varietal trial consisted of a duplicated five-way Latin Square to test the four Seraup selections against the local unselected Seri Raja. In Square A, no significant differences appear between the strains of Seraup though all exceed Seri Raja. In Square B, varietal means are very uniform and there are obviously no significant differences.

Results are shown in Table XVII.

Table XVII.

Square A.		Square B.
Variety.	Mean Yield per 1/120th acre in lbs.	Mean Yield per 1/120th acre in lbs.
S.K. 48 ...	17.1	15.5
S.K. 68 ...	16.0	15.6
S.K. 146 ...	16.8	15.3
S.K. 371 ...	17.0	15.0
Seri Raja ...	14.5	16.0
Mean	16.2	15.5
S.D. 0.93 lb. (5.7% of mean) M.S.D. 1.3 lbs.		Not analysed.

Kampong Kedah Padi Test Plot.

Being on rather higher land than the rest of the district, preparation of the Plot was not possible before September. Although somewhat late, a satisfactory season was experienced. There appears to be little difference between the Radin strains although R. 2 and R. 4 gave significantly lower yields in Square B than the other Radins. In Square C, Reyong 20 suffered severe rat damage, and one plot was destroyed by ducks. Consequently this Square was not considered worth analysis.

Results are shown below in Table XVIII.

Table XVIII.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
R. 2 ...	18.6	R. 2 ...	18.4
R. 7 ...	17.5	R. 4 ...	18.3
R. 11 ...	18.5	R. 7 ...	20.1
R. 13 ...	19.1	R. 11 ...	20.8
		R. 13 ...	20.2
Mean	18.4	Mean	19.6
S.D. 1.86 lbs. (10.1% of mean) M.S.D. 3.2 lbs.		S.D. 1.21 lbs. (6.2% of mean) M.S.D. 1.76 lbs.	

Table XVIII (*Contd.*)

Square C.

Variety.	Mean Yield per 1/120th acre in lbs.
Sm. 29 ...	19.9
M.E. 88 ...	22.1
M.E. 203 ...	19.0
Rey. 20 (mean of 3 plots) ...	17.8
Mean	19.7
Not analysed. Damaged.	

Bukit Gantang Padi Test Plot.

Conditions during the season were again rather unsatisfactory until the new Bukit Brapit dam, erected by the Drainage and Irrigation Department, came into operation on August 13th. From then onwards a sufficient supply of water was available. Towards the end of the season, heavy rains and their continuation through January provided an excess of water. This resulted in irregular ripening and lodging of much of the crop. Consequently harvesting was rendered difficult, and was therefore more prolonged than usual.

All the strains were in the nurseries far longer than desirable as cultivation of the land was held up owing to the late commencement of the operation by surrounding cultivators.

Apart from the presence of *Nymphula* in the early stages and a small amount of rat damage, the crop escaped pests.

In respect of yields the season was very satisfactory, the average yield over the whole Plot being at the rate of 425 gantangs per acre, the highest yet recorded here. Siam 76 was used as the main crop throughout the Plot.

Results are shown in Table XIX.

Table XIX.

Square A.		Square D.	Squares A & D combined
Variety.	Mean Yield per 1/120th acre in lbs.	Mean Yield per 1/120th acre in lbs.	Mean Yield per 1/120th acre in lbs.
S.K. 146 ...	24.5	24.0 ...	24.2
S.B. 15 ...	25.9	22.1 ...	24.0
S.K. 36 ...	21.6	18.6 ...	20.1
S.K. 48 ...	24.6	19.4 ...	22.0
Mean ...	24.2	21.2	22.6
S.D.	2.02 lbs. (8.4% of mean)	1.38 lbs. (6.6% of mean)	1.73 lbs. (7.6% of mean)
M.S.D.	3.3 lbs.	2.4 lbs.	2.6 lbs.

Square B.		Square C.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
Rey. 20 ...	13.2*	R. 11 ...	21.5
M.E. 210 ...	20.6	Sm. 29 ...	15.5
M.E. 203 ...	21.1	R. 13 ...	21.2
M.E. 88 ...	20.2	Sm. 76 ...	23.2
Mean	18.8	Mean	20.3
S.D. 2.65 lbs. (14.1% of mean) M.S.D. 4.6 lbs.		S.D. 2.46 lbs. (12.1% of mean) M.S.D. 4.3 lbs.	

* One plot damaged by rats gave only 11 lbs. against an average of 14 lbs. for the other three plots of this variety.

Lenggong Padi Test Plot.

The effective control of water-supply at this Plot caused trouble especially during wet weather. The growth of padi was well up to standard, but serious

losses resulted from rats and other pests, and much grain was lost through extensive lodging, particularly of Seraup varieties. Consequently, statistical analysis of the four Latin Squares was not made. Yields are recorded below in Table XX.

Preliminary selections of the local varieties, Chantek Puteh and Chantek Merah were made.

Table XX.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
S.K. 36 ...	20.0	R. 11 ...	20.9
S.K. 48 ...	17.5 (4 plots)	R. 13 ...	21.2
S.K. 68 ...	23.0	Sm. 29 ...	18.4
S.K. 371 ...	13.6 (4 plots)	Sm. 76 ...	19.6
M.K. 48 ...	16.7 (3 plots)	Rey. 20 ...	9.5
Mean	18.2 (21 plots)	Mean	17.9

Square C.		Square D.	
M.E. 210 ...	23.0	R. 2 ...	19.6
Sm. 29 ...	16.5	R. 11 ...	18.3
M.E. 208 ...	26.5	R. 1 ...	18.5
M.E. 203 ...	23.0	R. 13 ...	20.4
M.E. 88 ...	26.4	Mean	19.2
Mean	23.1		

Bruas Padi Test Plot.

Working on levelling and stumping was completed, and preparation for planting done in June. Shortage of water delayed planting but there was a good supply of water later when the irrigation dam was completed. Growth of padi was poor throughout the Plot and heavy losses resulted from attacks of stem-borers, rats and "penyakit merah". The six Latin Squares gave no results worth statistical analysis. A record of yields is shown in Table XXI.

Table XXI.

Variety.	Mean Yield per 1/120th acre in lbs.		Variety.	Mean Yield per 1/120th acre in lbs.	
	Square A.	Square B.		Square C.	Square D.
S. K. 36 ...	15.4	8.7	R. 1 ...	9.6	7.6
S.K. 48 ...	13.9	8.8	R. 11 ...	12.2	9.2
S.K. 146 ...	15.6	12.6	R. 13 ...	11.3	11.0
S.K. 371 ...	14.8	13.0	Rey. 20 ...	6.6	7.5
Mean	14.9	10.8	Mean	9.9	8.8

Variety.	Mean Yield per 1/120th acre in lbs.	
	Square E.	Square F.
Sm. 29 ...	10.7	12.3
Sm. 76 ...	10.1	10.0
R. 11 ...	10.4	10.9
R. 13 ...	9.5	9.1
Mean	10.2	10.6

Talang Experiment Station.

Selection.—Preliminary selections were made of Radin Che Nah, a very popular padi in the Kuala Kangsar District.

Introduced Varieties.—The Hong Kong varieties A and B were again grown. They proved as disappointing as formerly and were therefore discarded.

Twelve pure strains from Coimbatore were grown. Their maturation period was short, ranging from 121 days to 158 days from seed to harvest. Several of the varieties appear more promising than is generally the case with imported strains and Co. 2, 5, 7 and 10 together with T. 670 are being retained for further trial.

Table XXII records the results obtained.

Table XXII.

Variety.	Number of Plants.	Mean Weight of Grain per Plant, gms.	Average No. of Tillers.	Maturation (seed to harvest) (days)
Co. 2 ...	296	96.5	31	158
Co. 5 ...	210	96.7	38	158
Co. 7 ...	246	85.6	33	158
Co. 10 ...	126	29.5	20	121
T. 621 ...	144	36.5	22	110
T. 670 ...	105	63.8	19	139
G. E. B. 24 ...	207	70.5	32	138
A. E. B. 178 ...	112	89.0	19	142
Rascadam ...	218	23.1	18	127
Black Puttu ...	133	29.0	16	121
Sukadas ...	213	48.2	29	139
Vankisannam ...	219	36.7	18	151

Hybrids.—The hybrids under observation included two lines of N. 10 x N. 27, seven lines of R. 2 x Sm. 29, and the fifth generation of Ser. 875 x Sm. 29. A number of lines were cut out before harvest leaving seven to be carried on. Table XXIII records data of the hybrids retained.

Table XXIII.

Hybrid No.	Number of Plants	Average Tillers	Yield per Plant gms.	Maturation Period days
H 1/3 ...	250	18	80.5	190 R. 2 x Sm. 29
H 1/9 ...	250	18	96.2	190 R. 2 x Sm. 29
H 1/11 ...	150	17	85.2	188 R. 2 x Sm. 29
H 1/14 ...	200	18	93.8	188 R. 2 x Sm. 29
H 2a ...	1735	21	96.7	188 Ser. 875 x Sm. 29
Reciprocal (a) (N. 10 x N. 27)	28	18	56.1	
Reciprocal (b) (N. 27 x N. 10)	21	15	81.9	

Varietal Trials.—A successful season was experienced with the varietal trials, which were laid out in five four-way Latin Squares. Yields were, in general, rather better than those of the previous season and the weight to volume ratio of the grain was slightly greater. Details are shown in Table XXIV.

Table XXIV.

Variety.	Mean Yield per 1/120th acre in lbs.	
	Square A.	Square B.
S.K 48 ...	23.7	22.2
S.K. 146 ...	24.7	22.2
S.K. 371 ...	22.9	20.7
M.K. 48 ...	28.1	24.6
Mean ...	24.8	22.4
S.D.	1.61 lbs. (6.5 of mean)	4.38 lbs.
M.S.D.	2.8 lbs.	No significance.

Variety.	Square D.	Square E.	Squares D. & E. combined.
M.E. 88 ...	29.4	29.4	29.4
M.E. 202 ...	28.4	30.1	29.2
M.E. 203 ...	27.6	29.4	28.5
M.E. 210 ...	26.0	25.0	25.5
Mean ...	27.8	28.5	28.1
S.D.	1.31 lbs. (4.7% of mean)	1.87 lbs. (6.6% of mean)	1.61 lbs (5.7% of mean)
M.S.D.	2.3 lbs.	3.25 lbs.	1.8 lbs.

Table XXIV (*Contd.*)

Variety.	Square C.	
Sm. 29	26.2	
Sm. 76	24.8	S.D. 1.9 lbs. (1.9% of mean)
M.E. 203	24.1	M.S.D. 2.8 lbs.
N. 756	24.3	
R. 13	21.6	
Mean	24.2	

Sungei Manik Padi Test Plot.

This new Plot is situated in the recently opened Sungei Manik irrigated area. Twenty-four acres were planted with observation blocks of standard varieties including Seraup Kechil 36 and 48, Radins 11 and 13 and Siam 29. Lack of water resulted in the entire loss of the crop.

SELANGOR.

Panchang Bedena Padi Test Plot.

As in the 1934-35 season, this Plot gave practically no useful results. Lack of water, together with rats, stem-borers and other insect pests formed a combination of unfavourable factors which made accurate comparisons of varieties impossible. Four Latin Squares were laid down. Square D was completely destroyed by rats and borers, and Square C yielded a crop from eleven of the twenty-five sub-plots.

Yields and means are recorded in Table XXV.

Table XXV.

Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
S.B. 15 ...	14.9	R. 2 ...	10.1
R. 13 ...	10.7	R. 4 ...	6.3
S.K. 48 ...	10.7	R. 11 ...	5.6
S.K. 36 ...	14.3	R. 13 ...	9.9
Mean	12.6	Mean	8.0

Table XXV (*Contd.*)

Square C.		
Variety.	Mean Yield per 1/120th acre in lbs.	
Sm. 29 ...	7.3	Yield obtained from 13 out of 25 plots only. 11 plots destroyed by insects and rats.
N. 66 ...	8.0	
N. 756 ...	5.5	
F. 824 ...	2.0	
R. 13 ...	2.8	

Sungei Haji Durani Padi Test Plot.

The Plot was heavily flooded soon after transplanting and many young plants were lost. This necessitated extensive supplying. Later in the season serious rat damage occurred causing uneven crop. The growth of the padi was good, but too uneven for the varietial trials to be worth analysis. Mean yields are shown below in Table XXVI.

Table XXVI.

Square A.		Square C.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
S.K. 36 ...	9.3	F. 756 ...	9.1
S.K. 146 ...	12.0	F. 824 ...	7.7
S.K. 48 ...	11.0	N. 66 ...	5.4
R. 13 ...	7.5	Acheh ...	7.0
S.B. 15 ...	7.7	Sm. 29 ...	7.8
Mean	9.5	Mean	7.4
Square B.		**Square D.**	
R. 13 ...	10.5	Rey. 20 ...	10.7
Acheh ...	7.0	Acheh ...	8.0
R. 11 ...	12.6	R. 13 ...	8.4
R. 4 ...	12.9	M.E. 88 ...	9.7
R. 2 ...	6.0	M.E. 203 ...	8.4
Mean	9.8	Mean	9.0


PADI EXPERIMENT STATIONS
AND TEST PLOTS.
1935-6.
O EXPERIMENT STATIONS
X TEST PLOTS
PLOTS IN BRUNEI AND LABUAN ARE NOT INCLUDED.
SIAM
LANGKAWI IS.
X LANGKAWI
PERLIS
X KAMPONG SALANG
X SERIAB
X JITRA
X LANGGAR
O TELOK CHENGAI
X SALA KANAN
X PULAI
X RANTAU PANJANG
KEDAH
PENANG
GLUGOR X
PROV. WELLESLEY
X BUKIT MERAH
X LENGGONG
KUALA KURAU X
O TITI SERONG
X KAMPONG KEDAH
X BRIAH
X BAGAN SERAI
X Sg. KEPAR
X SELINSING
X BUKIT GANTANG
O TALANG
PERAK
X BRUAS
X Sg. MANIK
KELANTAN
O KOTA BAHRU
PASIR PUTEH X
TRENGGANU
X KUALA LIPIS
X DONG
PAHANG
X TEMERLOH
X Sg. BLAT
X BAWANG
X PEKAN
X PANCHANG BEDENA
X Sg. HAJI DURANI
X TANJONG KARANG
SELANGOR
X KUANG
X KAJANG
X KUALA KLAWANG
X AMPANG TINGGI
NEGRI SEMBILAN
X KENDONG
MALACCA
O PULAU GADONG
X JEMENTAH
X TANGKAK
X TENGLU
JOHORE
SINGAPORE
100°
101°
102°
103°
104°
6°
5°
4°
3°
2°
AR 1936

Tanjong Karang Padi Test Plot.

The Tanjong Karang Plot had a very much more successful season than during the previous year. A little rat damage occurred but it was not sufficiently serious to affect results appreciably. The yield of Reyong 20 in Square C is very high for the locality, averaging over 3,600 lbs. (about 650 gantangs) per acre. Square C shows an astonishingly high degree of significance, the "Z" ratio being 405.2 against 4.7 required.

Results are shown in Table XXVII.

Table XXVII.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
R. 2 ...	20.0	R. 2 ...	19.2
N. 756 ...	14.6	Sm. 29 ...	18.1
M.E. 203 ...	19.6	R.C. 12 ...	20.8
M.E. 88 ...	21.9	Rey. 20 ...	19.3
Mean	19.0	Mean	19.3
S.D. 2.17 lbs. (11.4% of mean) M.S.D. 3.8 lbs.		S.D. 3.66 lbs. No significance.	

Square C.		
Acheh ...	16.5	
R.S. 17 ...	11.8	
R.S. 34 ...	23.1	S.D. 0.8 lb. (3.9% of mean)
Rey. 20 ...	30.2	M.S.D. 1.4 lbs.
Mean	20.4	

Kuang Padi Test Plot.

Rats and insects again caused exceedingly heavy damage. Yields averaged 1 to 2 lbs. per 1/120th acre with a maximum of 3.6 lbs. per 1/120th acre (Siam 29). As this in no way represents the yielding ability of the land, figures are not recorded for the three Latin Squares which were laid down.

Kajang Padi Test Plot.

As this Plot is situated in a small isolated area of padi, results are usually poor owing to depredation by rats and birds. The season under review proved an exception, and the results of the one Latin Square laid down are shown in Table XXVIII.

Table XXVIII.

Variety.	Mean Yield per 1/120th acre in lbs.	
N. 27 ...	11.1	
Mk.P. 9 ...	13.2	S.D. 1.14 lbs. (10.5% of mean)
R.S. 34 ...	8.6	M.S.D. 1.98 lbs.
N. 756 ...	10.5	
Mean	10.9	

NEGRI SEMBILAN.

Kuala Klawang Padi Test Plot.

The site of this Plot was changed at the end of the 1934-35 season to a more favourable locality. Results of the five Latin Squares are shown in Table XXIX.

Table XXIX.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
S.B. 15 ...	9.1	R. 13 ...	6.0
S.K. 36 ...	7.6	R. 16 ...	6.5
M.K. 3 ...	8.7	R. 11 ...	5.6
S.K. 48 ...	7.7	R. 4 ...	4.6
Mean	8.1	Mean	5.7
S.D. 0.6 lbs. (7.4% of mean) M.S.D. 1.0 lb.		Yields low. Not analysed.	

Table XXIX (*Contd.*)

Square C.		Square D.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
M.E. 80 ...	7.9	Ser. K. ...	12.7
M.E. 209 ...	9.0	Sm. 29 ...	10.1
M.E. 203 ...	6.2	Rey. 20 ...	14.9
M.E. 202 ...	6.1	N. 66 ...	6.5
Mean	7.3	Mean	11.0

Square E.	
R. 4 ...	7.1
Mk.K. 3 ...	12.5
M.E. 203 ...	11.4
Sm. 29 ...	14.7
Mean	11.4

Ampang Tinggi Padi Test Plot.

This Plot which was utilized for the first time during the season 1935-36, suffered under the disadvantage of being situated on land which had been uncultivated for several previous seasons. Difficulty was therefore experienced in keeping weeds in check, and alterations in the positions of bunds added further trouble. Adjacent uncultivated land provided a sheltering place for rats which caused very heavy damage. Slight flooding of the Plot about a month before harvest resulted in some lodging and in uneven, delayed ripening of the crop. Consequently, the season was not particularly successful, although the yield over the whole Plot of about 300 gantangs (1,600 to 1,700 lbs.) per acre may be considered fairly good for the locality.

From observations made during the growing period, it appears that certain varieties are especially favoured by rats. Among such are all the strains of Radin Siak, and, to a considerable extent, Siam 29.

Results of the four Latin Squares are shown in Table XXX. Squares A, B and C were not considered worth analysis.

Table XXX.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
R. 2 ...	7.7	Sm. 29 ...	5.9
R. 11 ...	16.5	N. 11 ...	9.2
R. 13 ...	10.5	Mk. K. 3 ...	13.0
Ser. K. ...	16.1	Raja Bersanding	18.2
Mean	12.7	Mean	11.6

Square C.		Square D.	
R.S. 7 ...	10.2	M.E. 203 ...	22.2
R.S. 17 ...	6.9	Ser. 875 ...	10.9
R.S. 18 ...	8.6	Mk.P. 9 ...	15.4
R.S. 34 ...	9.4	Rey. 20 ...	24.9
Mean	8.6	Mean	18.4
		S.D. 1.48 lbs. (8% of mean) M.S.D. 2.6 lbs.	

Kendong Padi Test Plot.

In spite of little damage from pests, yields from this Plot were disappointing, none exceeding about 1,400 lbs. (250 gantangs) per acre. Milek Kuning 3, the highest yields, barely touches this figure. Serendah 875, planted rather too early, lost grain through attacks of birds. Results are recorded in Table XXXI.

Table XXXI.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
S.K. 48 ...	8.6	N. 66 ...	8.5
R. 13 ...	8.1	Sm. 29 ...	9.2
S.K. 36 ...	8.0	Ser. K. ...	7.2
S.B. 15 ...	9.4	R. 2 ...	7.6
Mean	8.5	Mean	8.2
Not analysed.		S.D. 1.09 lbs. (13.2% of mean) M.S.D. 1.9 lbs.	

Square C.		Square D.	
Ser. K. ...	9.8	R.S. 34 ...	10.2
Mk.K. 3 ...	12.4	R.S. 18 ...	7.8
N. 11 ...	7.4	R.S. 17 ...	9.9
Ser. 875 ...	4.5	R.S. 7 ...	10.1
F. 28 ...	7.8	R.S. 24 ...	7.1
Mean	8.4	Mean	9.0
S.D. 0.76 lb. (9% of mean) M.S.D. 1.1 lbs.		S.D. 1.61 lbs. (17.8% of mean) M.S.D. 2.3 lbs.	

MALACCA.

Pulau Gadong Experiment Station.

In general, a satisfactory season was experienced at this Station. A little damage from rats and insects occurred, but on the whole the Station remained fairly free from pests. Apart from flooding in August, weather conditions were good, especially at harvest when dry hot weather prevailed. Yields from this Station as a whole showed an increase of some fifty piculs over those of the previous season, and the quality of the grain was good.

The programme included selection, maintenance of pure lines of former selections, and varietal trials, summarized below:—

Selection.—Initial selection was done on two varieties from Pahang and on five from Negri Sembilan.

Seri Menjadi from Pahang, a tall 7-month variety has good straw, and a rather long white grain, bold in type. It has a strong tendency to produce awns. Yields are only moderate, the best line averaging 66 grams per plant. Several mixed lines were discarded.

Gandar, another tall 7-month variety from Pahang has a good straw, and large, bold, reddish grain, red tipped. It appears somewhat indifferent, the highest-yielding line averaging 50 grams per plant. The majority of lines were mixed.

Serendah Kuning, a dwarf variety from Negri Sembilan maturing in 7 months, has a round reddish-brown grain. The lines were uniform but the heaviest yielder averaged only 62 grams per plant.

Serendah Puteh, also from Negri Sembilan, is similar to Serendah Kuning except that the grain is white. The best line yielded an average of 59 grams per plant.

Serendah Salleh is an indifferent and mixed variety, the best line of which averaged 50 grams per plant.

Radin Guntor appears to be very poor. It is much inferior to the present Radin selections, and has a distorted panicle. It is being discarded.

Antar Bras, a tall variety, is later in maturation than the other varieties from Negri Sembilan. It appears to have a very poor yield, the best lines averaging only 41 grams per plant.

Serendah, a local variety, reached the second season of selection. The promise shown by the variety during the previous season was not fulfilled, and yields were distinctly indifferent. The average yield from 23 lines was 51 grams per plant, the best line giving only 68 grams per plant.

Field selection was done in the Central District of Malacca with the object of obtaining a selection of Siam with strong straw, irrespective of yield. Should this be found, it is hoped to cross a selection of this type with Siam 29 to obtain the good qualities of this variety together with better straw. Twenty-one localities were visited and seed secured for commencing ear-to-row selection during the 1936-37 season.

Introductions.—Twelve varieties received from Coimbatore unfortunately arrived somewhat late in the season, and then proved exceptionally precocious. Very little grain was secured, though enough was harvested to grow G.E.B. 24, T.670, Black Puttu, Rascadam, Varikisannam and Sukadas during the next season.

Pure Lines.—The pure lines of previous selections were continued. Yields were in general higher than those of the previous season. The best yielder was Nachin

11, with an average of 96 grams per plant. Siam 29 and Nachin 66, the pure strains most commonly planted by local cultivators, gave respectively 73.5 and 76.3 grams per plant.

Varietal Trials.—The varietal trials consisted of two Latin Squares, one occupied by five strains of the short-term Radin Siak, the other by four long-term varieties. The Radin Siak Square was unfortunately situated on land which is liable to flooding and which is somewhat uneven in fertility. On statistical analysis R.S. 17 appears just significantly better than R.S. 25; otherwise the Square yielded little information as to which of these selections is the best. The long-term Square was laid down primarily to compare two Milek Puteh strains, one from Titi Serong, the other a Malacca selection, and to compare their yields with two of the most generally satisfactory Malacca varieties, Siam 29 and Nachin 66. Both the Milek Puteh strains yielded satisfactorily and were significantly superior in yield to Nachin 66. Results are recorded below in Table XXXII.

Table XXXII.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
R.S. 34 ...	15.8	Sm. 29 ...	17.0
R.S. 69 ...	16.5	N. 66 ...	15.1
R.S. 25 ...	14.7	Mk.P. 148 ...	19.1
R.S. 24 ...	17.1	Mk.P. 9 ...	18.6
R.S. 17 ...	17.4		
Mean	16.3	Mean	17.4
S.D. 1.62 lbs. (10% of mean) M.S.D. 2.4 lbs.		S.D. 0.99 lb. (5% of mean) M.S.D. 1.7 lbs.	

JOHORE.

All Plots in Johore were utilized for the first time during the 1935-36 season. Consequently, work was confined to the growing of blocks of pure strain and local varieties for purposes of observation. In many cases, bunds had to be re-formed in more suitable positions, and uneven land resulting from this made accurate comparisons in the form of Latin Squares undesirable.

Tangkak Padi Test Plot.

Fourteen varieties, including ten pure strains and four local unselected varieties, were grown. The yields obtained, calculated to a uniform standard of gantangs per acre, are shown below in Table XXXIII.

Table XXXIII.

Variety.	Mean Yield, calculated in gantangs per acre.	Variety.	Mean Yield, calculated in gantangs per acre.
R. 2 ...	361	Sm. (local) ...	241
R. 7 ...	41 (Serious pest damage)	M.E. 203 ...	325
R.S. 17 ...	428	N. 11 ...	439
R.S. 24 ...	367	N. 66 ...	452
R.S. 34 ...	465	Serendah Kuning (local)	284
Sm. 29 ...	418	Sultan (local) ...	184
Sm. 76 ...	461	Serdang (local) ...	173

Jementah Padi Test Plot.

Yield indications at this Plot are variable; in some instances good crops were obtained, in others, yields were somewhat unsatisfactory. Levelling, alterations to bunds, damage by both drought and flood and extensive pest damage (particularly by borers) tended to obscure the real potentialities of the varieties grown. Results are recorded, calculated in gantangs per acre, in Table XXXIV.

Table XXXIV.

Variety.	Mean Yield, calculated in gantangs per acre.	Variety.	Mean Yield, calculated in gantangs per acre.
M.E. 203 ...	315	Sm. 29 ...	350
R. 2 ...	344	Lembut Tembiling (local)	451
N. 11 ...	83	Nachin Puteh ... (local)	216
N. 66 ...	232	Serendah Puteh ... (local)	177
R.S. 24 ...	33	Serendah Kuning (local)	337
R.S. 17 ...	152	Sm. 76 ...	389
R.S. 34 ...	191	R. 7 ...	126

Tenglu Padi Test Plot.

Lack of water control at this Plot adversely affected results, and *Nymphula* and stem-borers were responsible for a fair amount of damage. Rat damage was not serious, but wild pigs were troublesome. Mean yields calculated in gantangs per acre are shown in Table XXXVI.

Table XXXVI.

Variety.	Mean Yield, calculated in gantangs per acre.	Variety.	Mean Yield, calculated in gantangs per acre.
N. 66 ...	255	Rokat ...	105
Lantek ...	228	S.K. 146 ...	101
Sm. 29 ...	176	R.S. 17 ...	90
R. 4 ...	159	M.E. 203 ...	84
Trengganu ...	155	R.S. 24 ...	73
R.S. 34 ...	152	S.K. 52 ...	68
S.K. 36 ...	122	S.K. 48 ...	37
R. 2 ...	108		

PAHANG.

Temerloh Padi Test Plot.

On the whole the season was fairly satisfactory at this Plot. Pest damage was negligible during the growth period, though some damage was caused by birds and wild pigs during the earing and ripening stages. Owing to variation in water-depth, ripening and harvest were irregular. Lodging of Milek Kuning 2, Siam 29 and of the local variety Seri Ayer occurred as the land was under 1 to 3 feet of water at harvest. At the end of the season the Plot was abandoned in favour of a more suitable locality.

Selection.—Eight types of local padi (Seri Bumi, Milek Kuning, Gansar Melor, Gansar Jeleba, Gansar Halus, Milek Merah, Gansar Jebah and Manchar Kasar), were planted in lines of 500 plants each. On ripening, they were found to be a very mixed lot. They were sorted and a total of twenty-five types selected for further examination during the next season.

From the Seri Ayer selections of the previous season, fourteen types were selected and planted from ear to row, general data being recorded for the rows.

Introductions.—Observation plots were planted of Floating Padi, Padi Kelantan and Reyong 20. The latter was fairly satisfactory and gave a calculated yield of 319 gantangs per acre.

Varietal Trials.—Siam 29 again appears to be the best variety among those under trial in Latin Squares, with a calculated yield of 567 gantangs per acre against 609 in the previous season.

Results are shown in Table XXXIX.

Table XXXIX.

Square A.		Square B.	
Variety.	Mean Yield per 1/150th acre in lbs.	Variety.	Mean Yield per 1/150th acre in lbs.
Mk.K. 3 ...	11.9	N. 66 ...	7.6
Mk.P. 11 ...	2.9	M.E. 203 ...	7.6
Mk.K. 2 ...	5.0	Sm. 76 ...	12.1
Mk.P. 4 ...	6.6	Sm. 29 ...	20.4
Mean	6.6	Mean	11.9
S.D. 2.79 lbs. (42.2% of mean) M.S.D. 4.8 lbs.		S.D. 1.44 lbs. (8.2% of mean) M.S.D. 2.5 lbs.	

Square C.		
R.S. 34 ...	16.9	As one plot of Ser. 875 was not planted, no analysis of this Square was made.
Ser. 875 ...	10.3 (3 plots)	
R.S. 24 ...	4.3	
F.S. 12 ...	10.0	
Mean	10.4	

Dong Padi Test Plot.

Although pest damage was negligible, less favourable weather conditions, together with considerable lodging shortly before harvest, resulted in lower yields than in the previous season. Results are shown in Table XL.

Table XL.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
Mk.K. 3 ...	24.0	Mk.K. 2 ...	21.2
N. 11 ...	21.1	Sm. 29 ...	22.5
N. 66 ...	18.6	Mk.P. 11 ...	20.7
Rey. 20 ...	16.8	Mk.P. 9. ...	19.0
Sm. 29 ...	19.6	Mk.P. 148 ...	18.9
Mean	20.0	Mean	20.5
S.D. 1.67 lbs. (8.3% of mean) M.S.D. 2.4 lbs.		S.D. 2.79 lbs. (7.3% of mean) M.S.D. 4.1 lbs.	

Square C.		Square D.	
N. 756 ...	14.0	R.S. 17 ...	13.9
M.E. 203 ...	16.5	R.S. 18 ...	12.5
R.C. 4 ...	20.7	R.S. 24 ...	14.2
Sm. 29 ...	23.0	R.S. 34 ...	12.4
Mean	18.5	Mean	13.5
S.D. 1.6 lbs. (8.6% of mean) M.S.D. 2.8 lbs.		S.D. 1.70 lbs. (12.5% of mean) M.S.D. 2.9 lbs.	

Table XL (*Contd.*)

Square E.		
Variety.	Mean Yield per 1/120th acre in lbs.	
Mk.K. 3 ...	26.0	
Terong Papan ... (local)	17.7	
Serendah Puteh (local)	19.2	S.D. 3.33 lbs. (17.2% of mean)
Serendah Kuning (local)	19.0	M.S.D. 5.8 lbs.
Mean	20.7	

Kuala Lipis Padi Test Plot.

An unsatisfactory season was experienced at this Plot. Transplanting was delayed by dry weather and water shortage. Afterwards the short term varieties were damaged by flood. Growth was therefore very uneven and much supplying was necessary. As most of the main tillers were destroyed, the crop was harvested mainly from secondary tillers, and the results do not fairly indicate the capabilities of the varieties grown.

Jintan Merah, Gansar Tembiling Merah, Milek Puteh 148 and Nachin 11 appeared the most susceptible to flood damage.

The results of eight Latin Squares are shown in Table XLI.

Table XLI.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
Mk.K. 3 ...	10.9	Mk.K. 2 ...	7.5
Jintan Merah ...	1.5	Mk.K. 3 ...	14.7
Gansar Tembiling Merah ...	2.7	S.K. 36 ...	10.6
Gansar Tembiling Puteh ...	4.8	R. 13 ...	11.4
Mean	5.0	Mean	11.0
Not analysed.		S.D. 1.12 lbs. (10% of mean) M.S.D. 1.9 lbs.	

Table XLI (*Contd.*)

Square C.		Square D.	
Variety.	Mean Yield per 1/150th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
M.E. 210 ...	11.0	Mk.P. 9 ...	12.6
M.E. 203 ...	10.2	Mk.P. 7 ...	10.1
Sm. 29 ...	16.4	Sm. 29 ...	15.6
Sm. 76 ...	9.5	M.P. 148 ...	4.6
Mean	11.8	Mean	10.7
S.D. 1.54 lbs. (13% of mean) M.S.D. 2.7 lbs.		S.D. 1.53 lbs. (14.2% of mean) M.S.D. 2.7 lbs.	

Square E.		Square F.	
N. 11 ...	4.5	Mk.P. 9 ...	7.1
R. 2 ...	6.7	N. 27 ...	8.2
N. 66 ...	14.1	Kelantan ...	5.9
Rey. 20 ...	16.5	R.S. 24 ...	6.4
Sm. 29 ...	15.0		
Mean	11.4	Mean	6.9
S.D. 1.2 lbs. (10.5% of mean) M.S.D. 1.7 lbs.		Not analysed.	

Square G.		Square H.	
R.S. 24 ...	8.6	F.S. 12 ...	10.5
R.S. 34 ...	9.6	F.S. 875 ...	10.4
R.S. 17 ...	7.4	Sm. 29 ...	16.5
R.S. 18 ...	6.9	N. 756 ...	10.1
Mean	8.1	Mean	11.9
S.D. 1.39 lbs. (17.2% of mean) M.S.D. 2.4 lbs.		S.D. 2.64 lbs. (22.1% of mean) M.S.D. 4.6 lbs.	

Bawang Padi Test Plot.

The initial season at this new Plot was satisfactory. *Nymphula* was responsible for considerable damage at one stage of growth, and slight damage was caused by birds and wild pigs. No explanation of the very variable yields is given in the report on this Station.

The results of the seven Latin Squares are shown below in Table XLII.

Table XLII.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
R. 13 ...	5.0	Mk.K. 3 ...	3.9
R. 2 ...	9.4	Mk.P. 11 ...	3.3
M.E. 210 ...	4.7	Mk.P. 4 ...	4.4
Mk.K. 3 ...	6.0	Mk.K. 2 ...	3.1
Mean	6.3	Mean	3.6
Not analysed.			

Square C.		Square D.	
N. 756 ...	9.6	S.B. 15 ...	2.7
N. 27 ...	5.8	S.K. 48 ...	4.6
Ser. 824 ...	7.7	Seri Bumi ...	10.0
Sm. 29 ...	9.0	S.K. 36 ...	2.6
Mean	8.0	Mean	5.0
Not analysed.			

Table XLII (*Contd.*)

Square E.		Square F.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
R.S. 34 ...	10.5	Sm. 76 ...	12.9
R.S. 18 ...	9.5	N. 66 ...	14.6
R.S. 24 ...	12.8	Mk.K. 3 ...	16.9
R.S. 17 ...	10.7	Sm. 29 ...	12.1
Mean	10.9	Mean	14.1
S.D. 2.2 lbs. (20% of mean) M.S.D. 3.8 lbs.		S.D. 2.4 lbs. (17% of mean) M.S.D. 4.2 lbs.	

Square G.		
N. 27 ...	5.5	
R.S. 24 ...	9.1	
R.S. 17 ...	8.8	S.D. 1.1 lbs. (14% of mean)
R.S. 18 ...	7.7	M.S.D. 1.9 lbs.
Mean	7.8	

Sungei Blat Padi Test Plot.

This Plot, utilized for the second time during the season under review, is situated on land recently cleared from swamp jungle. Consequently, there are still stumps and logs on the ground and the soil is very uneven. Results, therefore, lack uniformity. For the second season Siam 29 again appears to be generally the most satisfactory variety on the Plot.

Results are shown in Table XLIII.

Table XLIII.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
Sm. 29 ...	14.6	Mk.K. 3 ...	6.2
N. 66 ...	10.3	Mk.K. 2 ...	5.2
Mk.P. 11 ...	10.6	Mk.P. 148 ...	5.8
Mk.P. (local) ...	12.7	Kelantan (local)	2.8
Mean	12.0	Mean	5.0
Yields too irregular for analysis.			

Square C.		Square D.	
Mk.K. 2 ...	7.0	R. 13 ...	4.1
Mk.P. 148 ...	5.5	Rey. 20 ...	10.1
Kelantan (local)	1.9	Sm. 29 ...	7.3
Mk.K. 3 ...	7.9	M.E. 203 ...	3.0
Mean	5.6	Mean	6.1
Yields too irregular for analysis.			

Square E.		Square F.	
M.E. 203 ...	10.2	Rey. 20 ...	9.0
Rey. 20 ...	8.1	R. 13 ...	9.4
R. 13 ...	9.5	Sm. 29 ...	13.5
Sm. 29 ...	13.1	M.E. 203 ...	9.8
Mean	10.2	Mean	10.4
S.D. 0.94 lb. (9.2% of mean) M.S.D. 1.6 lbs.		S.D. 2.09 lbs. (20% of mean) M.S.D. 3.6 lbs.	

Table XLIII (*Contd.*)

Square G.		Square H.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
Mk.P. (local) ...	7.9	N. 66 ...	8.6
Sm. 29 ...	8.4	Mk.P. 11 ...	11.5
N. 66 ...	9.6	Mk.P. (local) ...	13.9
Mk.P. 11 ...	5.6	Sm. 29 ...	11.1
Mean	7.9	Mean	11.2
Not analysed.			

Pekan Padi Test Plot.

The crop was very heavily flooded at harvest, reaping taking place with 5 to 6 feet of water on the plot. Losses amounted in some cases to 50 per cent. of the total, thus rendering results of little value. Mean yields only are recorded in Table XLIV.

Table XLIV.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
Sm. 29 ...	2.4	Sm. 29 ...	5.0
M.E. 210 ...	1.5	Mk.P. 7 ...	3.8
M.E. 203 ...	1.0	Mk.P. 4 ...	4.6
Rey. 20 ...	1.6	Mk.P. 11 ...	4.3
Mean	1.6	Mean	4.4

Table XLIV (*Contd.*)

Square C.		Square D.	
Variety.	1/120th acre in lbs. Mean Yield per	Variety.	Mean Yield per 1/120th acre in lbs.
Sm. 29 ...	6.4	Sm. 29 ...	7.1
Mk.K. 2 ...	4.3	N. 66 ...	4.7
Mk.K. 3 ...	7.5	Sm. 76 ...	5.6
F.S. 12 ...	2.4	N. 756 ...	2.7
Mean	5.1	Mean	5.0

Square E.		Square F.	
R.S. 24 ...	4.7	Anak Terus ...	6.5
R.S. 18 ...	3.3	Seri Ayer ...	5.2
R.S. 34 ...	5.8	Seri Bumi ...	5.7
R.S. 17 ...	5.3	Sm. 29 ...	8.8
Mean	4.8	Mean	6.5

KELANTAN.

Central Experiment Station.

The varietal trials consisted of a six-way Latin Square for dry padi, a randomized block containing seven varieties of dry padi, two six-way and two four-way Latin Squares for wet padi. Plot B, particularly the variety Jintan Koring, suffered losses from bird damage. Plots C and D were manured with bat guano at the rate of 360 lbs. per acre.

Results are shown in Table XLV.

Table XLV.

Square A. (Dry Padi)		Square B. (Dry Padi)	
Variety.	Mean Yield per 1/80th acre in lbs	Variety.	Mean Yield per 1/80th acre in lbs
Jintan Koring ...	17.9	Jintan Koring ...	10.0
Jintan Manis ...	18.0	Kaki Merpati 2	17.0
Sa Bumi Puteh ...	22.9	K.M. 3 ...	21.0
Padang Serai ...	20.0	K.M. 5 ...	21.2
Kaki Merpati ...	22.9	Padang Serai 13	18.1
Anak Lebah ...	18.7	K.M. 19 ...	19.2
		K.M. 21 ...	20.6
Mean	20.1	Mean	18.2
S.D. 2.64 lbs. (13.2% of mean) M.S.D. 3.4 lbs.		No analysis made owing to unsatisfactory lay-out.	

Square C.		Square D.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
R. 13 ...	19.7	S.B. 15 ...	26.5
R. 2 ...	11.8	M.E. 203 ...	22.5
N. 66 ...	15.9	S.K. 48 ...	22.4
Sm. 76 ...	17.2	R. 2 ...	19.2
Sm. 29 ...	22.7	S.K. 36 ...	27.5
N. 27 ...	13.7	R. 4 ...	25.3
Mean	16.8	Mean	23.9
S.D. 3.18 lbs. (18.9% of mean) M.S.D. 4.1 lbs.		S.D. 1.91 lbs. (8% of mean) M.S.D. 2.5 lbs.	

Table XLV (*Contd.*)

Square E.		Square F.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
R.S. 7 ...	20.5	Padang Trengganu (unselected) ...	17.2
R.S. 17 ...	19.4	P.T. 2 ...	18.2
R.S. 18 ...	19.3	P.T. 4 ...	18.2
R.S. 24 ...	19.6	P.T. 5 ...	20.4
Mean	19.7	Mean	18.5
No significant differences.		S.D. 0.99 lb. (5.3% of mean) M.S.D. 1.7 lbs.	

Pasir Puteh Padi Test Plot.

The varieties in the trial plots suffered more or less severe lodging as a result of a storm a few days before harvest. Siam 29 and Nachin 66 suffered most severely and Radin 13 and 4, Nachin 765 and Serendah 824 the least.

Results are shown in Table XLVI.

Table XLVI.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
N. 756 ...	13.6	R. 4 ...	18.1
Ser. 824 ...	19.8	Sm. 76 ...	18.1
Sm. 29 ...	19.5	Sm. 29 ...	17.2
N. 66 ...	20.2	R. 13 ...	18.9
Mean	18.3	Mean	18.1
S.D. 1.25 lbs. (6.8% of mean) M.S.D. 2.2 lbs.		S.D. 1.1 lbs. (6.1% of mean) M.S.D. 1.9 lbs.	

Table XLVI (*Contd.*)

Square C.		Square D.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
Serendah ...	19.2	Chateh ...	18.6
Sm. 29 ...	16.5	Sm. 29 ...	15.2
Nalong ...	20.5	Anak Ikan Tinggi ...	6.5
Manik Siam ...	21.2	Anak Ulat ...	18.3
Padang Trengganu	19.8	Anak Naga ...	12.4
Mean	19.4	Mean	14.2
S.D. 1.43 lbs. (7.4% of mean) M.S.D. 2.1 lbs.		S.D. 2.83 lbs. (20% of mean) M.S.D. 4.1 lbs.	

BRUNEI AND LABUAN.

Work on the four new Test Plots, Berakas, Bukit Kallam, Kuala Abang and Lumapas was confined to preparation of land and the planting of a few varieties of padi in observation blocks. There are no results to be recorded from these Plots.

At Kilanas Padi Test Plot, six Latin Squares were planted and the results are recorded in Table XLVII.

Table XLVII.

Square A.		Square B.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
S.B. 15 ...	18.2	R. 2 ...	7.8
Jonkok ...	18.9	Jonkok ...	4.8
S.K. 48 ...	17.2	R. 4 ...	7.6
S.K. 36 ...	19.9	R. 13 ...	7.6
Mean	18.3	Mean	6.9
S.D. 1.81 lbs. (9.8% of mean) M.S.D. 3.1 lbs.		Not analysed.	

Table XLVII (*Contd.*)

Square C.		Square D.	
Variety.	Mean Yield per 1/120th acre in lbs.	Variety.	Mean Yield per 1/120th acre in lbs.
Rey. 6 ...	13.4	Sm. 29 ...	21.3
Rey. 20 ...	13.8	Sibahit ...	10.0
M.E. 80 ...	7.0	N. 66 ...	17.0
M.E. 88 ...	12.0	Sm. 76 ...	19.0
Mean	11.5	Mean	16.8
Uneven yields. Not analysed.		S.D. 1.4 lbs. (8.3% of mean) M.S.D. 2.4 lbs.	

Square E.		Square F.	
R.S. 7 ...	18.0	Rey. 6 ...	15.5
R.S. 17 ...	17.6	Rey. 20 ...	16.1
R.S. 18 ...	15.9	M.E. 80 ...	11.0
R.S. 24 ...	12.7	M.E. 88 ...	14.9
Mean	16.0	Mean	14.4
S.D. 2.72 lbs. (17% of mean) M.S.D. 4.7 lbs.		S.D. 2.24 lbs. (15.5% of mean) M.S.D. 3.9 lbs.	

Summary.

This report summarizes the varietal trials and selection work carried out on padi during the 1935-36 season. In the summary of the report on the 1934-35 season* an outline of the general position was given. Certain modifications are necessary in view of results obtained during the season under review and the general position is therefore brought up to date in the summary given below.

* See *Malayan Agricultural Journal*, Vol. XXIV, No. 2, February, 1936, pp. 83-85.

The season was unsatisfactory at many of the Test Plots, unfavourable weather and pests being responsible for results so uneven that they were not considered worth statistical treatment. Figures from such Plots are included in the summary for departmental reference, but it should be understood that they do not, in most instances, represent the true capabilities of the given strains at the localities in question.

Krian.

In North Krian, further trials have not altered the previous opinion that Seraup Kechil 48 is a satisfactory strain for the soft land and deep water of the area. The selections Seraup Kechil 146 and 371 do not yet appear, on the information obtained, to be sufficiently superior to this strain to warrant their general distribution.

In Southern Krian, trials with Siam 29 on "ketua plots" (demonstration plots on land owned by *ketua*—headmen) have shown that the previously expressed opinion on the suitability of this variety to local conditions was incorrect. The variety proved unpopular owing to the comparatively low weight-volume ratio, a factor of importance in a district where much of the crop is sold by weight, and to the weak straw which lodges readily and is liable to rot under wet harvesting conditions rendering harvesting more difficult and costly. As an adequate supply of irrigation water is now available in South Krian, it is reported that there is a tendency to plant longer-maturation varieties, such as the Seraups which are popular in North Krian, because of their heavier yield of grain. It is probable, however, that Siam 29 may find a limited use for domestic purposes as the rice obtained is reputed to be superior to that of the Seraups.

Kedah.

In this State the position remains practically unaltered. Results of the 1935-36 season confirm the previous opinion that, according to locality, one of the six varieties Chubai 18, Mayang Ebus 88, Radin Che Nah 28, Radin China 4, Radin China 17 or Reyong 20 may be confidently recommended to the planter. Selection of new strains in the hope of finding something even better is proceeding at the Experiment Station at Telok Chengai.

Malacca.

For general planting Siam 29 and Nachin 66 still remain the most popular and satisfactory varieties. Further trials with Radin Siak varieties, useful in limited areas where the season is shorter than normal or where only a limited water supply is available, have failed to show which of the four final selections is the best. In fact, there appears to be little to choose between them.

Province Wellesley.

The two varieties mentioned in the previous report, Siam 29 and Mayang Ebus 203 have again been satisfactory and Mayang Ebus 210 may now be added

as a likely selection for areas where the land is not excessively rich and soft or the water deep. Further trials are, however, necessary before it is safe to make definite recommendations.

Other Localities.

In localities other than those mentioned above, no definite recommendations can be made until results over a longer period are available for review. In most localities, except those where wet harvesting conditions are usual, it appears that Siam 29 is probably the best yielding and most popular variety, but more extensive trial against local varieties and other selections is necessary.

PADI MANURIAL AND MINOR CULTURAL TRIALS 1935 - 1936

Compiled by
R. G. H. Wilshaw,
Rice Research Chemist.

Standard Experiments.

During the 1935-1936 season, in addition to a few small manurial and cultivation trials, three standard manurial experiments have been carried out at different Stations in Perak, Province Wellesley and Malacca. These three manurial trials, laid out as follows are, for the sake of brevity, subsequently referred to as Normal Phosphate, Heavy Superphosphate and Heavy Rock Phosphate Dust Trials.

Normal Phosphate Trial.—A 4 x 4 Latin Square, 1/120th acre plots receiving the following treatments:—

(1) A proprietary brand of complete fertilizer—at the rate of 2 piculs per acre.
(2) Rock phosphate dust—at the rate of 1 cwt. per acre.
(3) Superphosphate—at the rate of 1 cwt. per acre.
(4) Control—no manure.

Designed to test responses to low level dressings of phosphate, and to afford a comparison between a proprietary brand and the usual rock and superphosphate. The proprietary brand had the composition:—

	per cent.
Nitrogen	7
Phosphate	14
Potash	1

Heavy Rock Phosphate Dust Trial.—A 4 x 4 Latin Square, 1/360th acre plots receiving the following treatments:—

(1) Control—no manure.
(2) 16 cwt. rock phosphate dust per acre.
(3) 32 cwt. rock phosphate dust per acre.
(4) 48 cwt. rock phosphate dust per acre.

Designed to test the effect of extremely high phosphate dressings, and to ascertain whether, by this method, yields could be raised to any extent beyond the 'bar',* either in the year of application or in subsequent seasons, when the slow liberation and utilization of phosphate might be evidenced in high residual effects.

Heavy Superphosphate Trial.—A 4 x 4 Latin Square, 1/360th acre plots receiving the following treatments:—

(1) Control—no manure.
(2) 16 cwt. superphosphate per acre.
(3) 32 cwt. superphosphate per acre.
(4) 48 cwt. superphosphate per acre.

* *Malayan Agricultural Journal,* Vol. XXII, p. 583, December, 1934.

Designed for the same purpose as the Heavy Rock Phosphate Dust Trial.

The complete set of manurial and cultivation trials follows.

Normal Phosphate Trials.

These trials were carried out at:—

Selangor	Kuang
Perak	Kuala Kurau Bagan Serai Briah Sungei Kepar Selinsing Titi Serong Talang
Province Wellesley	Bukit Merah
Malacca	Pulau Gadong

Descriptions of the soils at these Stations and Test Plots have been published in this Journal.†

At Kuang the trial was a failure due to rats and birds, and no crop was harvested from any plot. With this exception, the yields at the different places are given in Table I.

Table I.

Normal Phosphate Trials.

Mean Yield in lbs. per 1/120th acre.

Station.	Proprietary Brand	Rock Dust	Super	Control
Kuala Kurau ...	32.1	31.6	32.2	31.8
Bagan Serai ...	20.9	20.1	18.2	15.8
Briah ...	17.5	19.6	17.5	18.9
Sungei Kepar ...	19.9	19.6	20.6	19.0
Selinsing ...	17.5	17.8	16.3	14.9
Titi Serong ...	19.6	19.5	17.7	17.9
Talang ...	30.7	29.1	29.3	30.0
Bukit Merah ...	17.8	15.5	17.0	12.0
Pulau Gadong ...	25.9	26.7	26.5	25.2

† *Malayan Agricultural Journal,* Vol. XIX, p. 595, December, 1931.
Malayan Agricultural Journal, Vol. XX, p. 618, December, 1932.
Malayan Agricultural Journal, Vol. XXI, p. 629, December, 1933.

Statistical analysis of the yield figures shows that significant increases over the control plots by a manurial treatment were obtained only at Bagan Serai, Selinsing, Titi Serong and Bukit Merah.

The full analyses for these four places are given in Table II:—

Table II.

Bagan Serai

Treatment.	Yield in lbs. per 1/120th acre	
Proprietary brand ...	20.91	S.D. = 1.16 lbs. = 6.2% of general mean.*
Rock phosphate dust ...	20.1	M.S.D. = 2.0 lbs.
Superphosphate ...	18.25	I.C. = 1.6 lbs.
Control ...	15.8	
Mean	18.8	

Selinsing.

Proprietary brand ...	17.5	S.D. = 1.1 lbs. = 6.6% of general mean.
Rock phosphate dust ...	17.8	M.S.D. = 1.9 lbs.
Superphosphate ...	16.3	I.C. = 1.5 lbs.
Control ...	14.9	
Mean	16.6	

Titi Serong.

Proprietary brand ...	19.6	S.D. = 0.97 lb. = 5.2% of general mean.
Rock phosphate dust ...	19.5	M.S.D. = 1.7 lbs.
Superphosphate ...	17.75	I.C. = 1.3 lbs.
Control ...	17.9	
Mean	18.9	

* S.D. = Standard Deviation.
M.S.D. = Minimum Significant Difference.
I.C. = Increase over control plot necessary to attain significance.

Bukit Merah.

Treatment.		Yield in lbs. per 1/120th acre	
Proprietary brand	...	17.8	S.D. = 1.4 lbs. = 9% of general mean.
Rock phosphate dust	...	19.5	M.S.D. = 2.4 lbs.
Superphosphate	...	17.0	I.C. = 1.9 lbs.
Control	...	12.0	
Mean		15.6	

It will be noticed that a high order of uniformity is obtained in all these trials, as reflected in the standard deviation figures expressed as a percentage of the general mean.

The conclusion reached is that though on four out of twelve Stations significant increases were obtained by the use of differing types of phosphatic manures at low application rates, when consideration is paid to the economic side, it will be found that rock phosphate dust costing $30 per ton ex-godown is the only fertilizer at all likely to repay for its application. The figures on which this conclusion is based are a selling price of padi of $1.75 per picul and the market prices of the fertilizers, plus railway freight.

Heavy Rock Phosphate Dust Trials, and Heavy Superphosphate Trials.

Both these trials were carried out at:—

Kedah	Telok Chengai
Province Wellesley	Bukit Merah
Perak	Titi Serong
	Selinsing
	Briah
	Sungei Kepar
	Bagan Serai
	Kuala Kurau
	Talang
	Bruas
Negri Sembilan	Kendong
Malacca	Pulau Gadong

Table III.
Heavy Rock Phosphate Dust Trials.
Mean Yield in lbs. per 1/360th acre.

Station.	Control	16 cwts.	32 cwts.	48 cwts.
Telok Chengai ...	9.4	9.8	10.1	10.4
Bukit Merah ...	6.1	7.75	7.5	7.6
Titi Serong ...	9.25	9.0	8.75	8.44
Selinsing ...	6.6	6.16	6.98	6.94
Briah ...	5.65	5.6	5.84	5.57
Sungei Kepar ...	7.2	7.1	7.5	6.8
Bagan Serai ...	7.94	7.56	7.31	7.6
Kuala Kurau ...	10.1	10.9	10.0	10.6
Talang ...	11.6	11.3	11.0	11.9
Kendong ...	4.75	4.8	3.6	3.75
Pulau Gadong ...	6.7	6.5	6.75	6.25
Bruas ...	1.8	1.7	1.5	2.9

Table IV.
Heavy Superphospate Trials.
Mean Yield in lbs. per 1/360th acre.

Station.	Control	16 cwts.	32 cwts.	48 cwts.
Telok Chengai ...	9.25	9.2	9.05	8.5
Bukit Merah ...	6.6	6.25	6.1	6.2
Titi Serong ...	9.0	8.9	8.6	8.6
Selinsing ...	6.20	6.06	6.36	6.06
Briah ...	5.65	3.90	4.63	4.87
Sungei Kepar ...	6.9	7.3	7.2	7.3
Bagan Serai ...	7.7	7.25	6.6	6.2
Kuala Kurau ...	10.7	11.0	10.8	11.2
Talang ...	10.2	8.8	5.3	3.3
Kendong ...	3.4	4.75	4.9	5.0
Pulau Gadong ...	7.25	8.1	8.3	8.06

At Bruas, the crop was a failure as the plants did not flower, and the superphosphate trial at Briah suffered from bad rat damage. The yields obtained are given in Tables III, IV and V.

The effect of the heavy phosphate dressings is not very noticeable and no special effects of the order sought were obtained.

At three places only, significant differences emerged: at Bukit Merah there was an increase in yield with rock phosphate; at Bagan Serai and Talang there was a decrease in yield with superphosphate.

Detailed analyses are given in Table V:—

Table V.

Bukit Merah.

Treatment.	Mean Yield in lbs. per 1/360th acre.	
Control ...	6.1	S.D. = 0.43 lbs. = 6% of general mean.
16 cwt. rock phosphate dust per acre ...	7.75	M.S.D. = 0.76 lb.
32 cwt. rock phosphate dust „ ...	7.5	I.C. = 0.6 lb.
48 cwt. rock phosphate dust „ ...	7.6	
Mean	7.25	

Bagan Serai.

Control ...	7.7	S.D. = 0.41 lb. = 5.9% of general mean.
Superphosphate 16 cwt. per acre. ...	7.25	M.S.D. = 0.71 lb.
Superphosphate 32 cwt. „ ...	6.6	D.C. = 0.56 lb.
Superphosphate 48 cwt. „ ...	6.2	
Mean	6.95	

Talang.

Control ...	10.2	S.D. = 1.25 lbs. = 18% of general mean.
Superphosphate 16 cwt. per acre. ...	8.8	M.S.D. = 2.2 lbs.
Superphosphate 32 cwt. „ ...	5.3	D.C. = 1.72 lbs.
Superphosphate 48 cwt. „ ...	3.3	
Mean	6.9	

It must be borne in mind that the dressings of phosphate applied in this experiment are exceedingly high and of an order sufficiently great to upset the normal balance of nutrients in the soil. It is surprising when the small working balance of nutrients in these soils is considered, that no more striking results have ensued.

These trials will be continued during the 1936-1937 season for observation on residual effect. It is quite probable that the slow liberation of phosphate from these heavy dressings will not be evidenced for a year or two.

Special Experiments.

In addition to the standard experiments, a number of special experiments were carried out in Kelantan and Pahang.

Central Experiment Station, Kota Bahru.—The programme at this Station consisted of three experiments on dry padi and eight on wet padi. Results and conclusions are as follows:—

DRY PADI.

1. *Seed per Hole Experiment.*

Table VI.

Treatment.	Mean Yield in lbs. per 1/80th acre.	
2 seeds per hole ...	8.4	S.D. = 3.0 lbs. = 35.5% of general mean.
4 seeds per hole ...	11.2	M.S.D. = 3.9 lbs.
6 seeds per hole ...	8.0	
8 seeds per hole ...	9.0	
10 seeds per hole ...	6.6	
12 seeds per hole ...	7.6	
Mean	8.5	

Although treatment B, 4 seeds per hole, reaches significance over E, 10 seeds per hole, there is no general response as indicated by the 'Z' test. Taking this in conjunction with heavy bird damage sustained, no conclusions can be drawn.

2. *Cultivation Experiment.*

Table VII.

Treatment.	Mean Yield in lbs. per 1/60th acre.	
Changkol 1934, plough and harrow 1934 and 1935 ...	15.9	S.D. = 3.6 lbs. = 19.7% of general mean.
Plough and harrow 1934 and 1935 ...	15.4	M.S.D. = 6.2 lbs.
Plough and harrow 1934 late changkol 1935 plough and harrow 1935 ...	23.4	
Mean	18.2	

The effect of changkolling during the season is evident by the significance of treatment C over A and B. No residual effect of the 1934 changkolling is evidenced by comparison of A with B.

3. *Manurial Experiment.*

Rain and birds damaged this experiment to such a heavy extent as to render the results valueless.

WET PADI.

The wet padi experiments consisted of a spacing experiment, one cultivation experiment, and six manurial experiments. Significant differences were obtained only in four of the manurial trials. (Tables VIII—XI).

Table VIII.

Bat Guano.

Treatment.	Mean Yield 1/60th acre. in lbs. per	
1 cwt. bat guano per acre	61.0	S.D. = 3.04 lbs. = 4.6% of general mean.
2 cwt. bat guano per acre	62.1	M.S.D. = 5.3 lbs.
3 cwt. bat guano per acre	68.2	I.C. = 4.2 lbs.
Control	54.0	
Mean	61.3	

All the guano treatments show significant increases over the control, and the heaviest dressing over the two lighter.

Table IX.

Phosporus: Nitrogen Ratio.

Treatment. (in cwts. per acre) Super-phosphate	Ammonium sulphate	Mean Yield in lbs. per 1/60th acre.	
2	0	44.4	S.D. = 3.65 lbs. = 7.4% of general mean.
2	1	48.4	
2	2	52.4	M.S.D. = 6.35 lbs.
2	3	52.4	
Mean		49.4	

This experiment confirmed indications obtained in the 1934 experiments, that phosphate alone is an insufficient dressing for this soil, and added nitrogen is required. This conclusion is still further supported by the results of the following experiment repeated from 1934-1935.*

Table X.

Treatment.	Mean Yield in lbs. per 1/40th acre.	
N.P.K. basic ...	68.3	S.D. = 7.0 lbs. = 10.2% of general mean.
Superphosphate ...	63.8	M.S.D. = 9.0 lbs.
Super + ammonium sulphate ...	70.4	I.C. = 7.3 lbs.
Super + am. sulphate + am. sulphate	78.0	
Basic slag + cyanamide ...	72.8	
Control — no manure ...	58.7	
Mean ...	68.6	

A second manurial square with organic fertilizers, also a repetition, gave similar results to the previous season.

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* *Malayan Agricultural Journal,* Vol. XXIV., No. 2, p. 90, February, 1936.

Table XI.

Treatment.	Mean Yield in lbs. per 1/40th acre.	
Green manure and guano ...	67.4	S.D. = 7.2 lbs. = 10.9% of general mean.
Green manure, guano and sulphate of potash ...	73.8	M.S.D. = 9.3 lbs.
Bat guano and sulphate of potash ...	62.5	I.C. = 7.5 lbs.
Cow dung ...	70.1	
Baja bakar † ...	66.3	
Control — no manure ...	56.5	
Mean ...	66.1	

Pasir Puteh Test Plot.—Two experiments were laid down at this Station, one manurial, and one nursery. The latter gave no results of value. The former gave results confirming previous findings that a ready response may be obtained on this soil by the application of phosphate manure, and possibly by simple cultivation such as changkolling. (Table XII).

Table XII.

Treatment.	Yield in lbs. per 1/40th acre.	
1 cwt. bat guano per acre ...	58.3	S.D. = 6.3 lbs. = 11.5% of general mean.
2 cwt. bat guano per acre ...	54.4	M.S.D. = 8.1 lbs.
3 cwt. bat guano per acre ...	57.3	I.C. = 6.5 lbs.
5 tons cow dung ...	58.3	
Residual effect of 5 tons green manure from 1934 to 1935 ...	49.0	
Changkolled ...	53.7	
Residual effect 4 cwt. bat guano from 1934 to 1935 ...	57.1	
Control ...	47.0	
Mean ...	54.4	

† A mixture of burnt soil, burnt cow dung, and ashes of coconuts and areca leaves in general use in Kelantan under the name of *baja bakar.*

In Pahang, a series of cultivation experiments for comparison of the practices of tajak, tenggala, melanyak, and changkol were instituted at the various Test Plots throughout the State. Very little positive information was derived from these experiments as in many cases the yields were too variable, and in other cases no significant differences were obtained.

Subsidiary Experiments.

Small subsidiary experiments on cultivation and manuring were carried out at Pulau Gadong, Kendong, Ampang Tinggi, Kuala Klawang, but gave no results of any value.

At Titi Serong, subsidiary experiments in connexion with the clearing of the bendangs and the disposal of straw afforded no information.

At Briah, however, in a cultivation experiment, changkol versus tajak, although negative to the 'Z' test, the mean difference reached the level of significance. (Table XIII).

Table XIII.

Treatment.	Yield in lbs. per 1/20th acre.	
Changkol ...	19.2	S.D. = 2.2 lbs. = 12% of general mean.
Tajak ...	17.5	M.S.D. = 1.1 lbs.
Mean	18.35	

At Selinsing, the cultivation and manuring experiment which was reported on last year,* was replanted for observation of residual effects. The results obtained are given in Table XIV.

Table XIV.

Cultivation and Manuring Experiment at Selinsing Station.

Mean Yield in lbs. per 1/80th acre.

Treatment.	Control	P	N.P.	Mean
Changkol ...	21.8	23.25	23.05	22.7
Tajak ...	19.7	21.4	20.35	20.5
Mean	20.76	22.3	21.7	

* *Malayan Agricultural Journal*, Vol. XXIV, No. 2, p. 87, February, 1936.

The analysis table is as follows:—

	D.F.	Σd^2	V.	S.D.
Total	23	96.7		
Between blocks ...	1	3.9		
Between cultivation treatments ...	1	30.1		
Between manures ...	2	9.8		
Interaction ...	2	0.8		
Residue (Error) ...	17	52.1	3.06	1.93

M.S.D. between cultivation means = 1.7 lbs.

M.S.D. between manurial means = 2.1 lbs.

As was found last season the land is of reasonably uniform fertility. There remains a significant effect due to cultivation but not to manures.

Summary.

In summarizing the results of experiments this season, it might perhaps be opportune to review in broad outline the position which has now been reached with padi manurial trials.

Previous to 1930 there were indications that phosphatic fertilizers would give increased yields. Experiments on three Stations in 1931 hardly confirmed this, but since then, the abundance of evidence points to the fact that increases can be obtained with phosphatic manures, though the proposition is likely to be uneconomic if the usual phosphatic fertilizers are employed. Results this season, however, show the possibility of rock phosphate dust being an economic fertilizer in certain districts.

Nitrogen in the usual forms is unlikely to give increases and is certainly not economic, and in combination with phosphate, normally gives no added increase over phosphate alone.

During 1933 and 1934 efforts were made to obtain increased yields by combining manuring with close planting, with green manuring, and with surface cultivations of various types. No substantial increases, however, were obtained, nor was any clue found which would suggest a solution to the problem of raising yields above the 'bar'* frequently referred to in previous papers.

The heavy phosphate experiments carried out this season were aimed at obtaining a clue to the same problem, but no immediate information has been gained.

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* *Malayan Agricultural Journal*, Vol. XXII, p. 583, December, 1934.

It is interesting to note that in the results of pot culture experiments with padi, recently published,† heavy dressings of phosphate had a depressing effect on yield, and it was concluded that the optimum dressing was of the order of 10 cwt. per acre.

In the same publication, the results with insoluble forms of nitrogen suggest that the use of ground horn might give yields well above the 'bar'. For next season, experiments have been laid down to test this under field conditions, and to give indications as to its economic possibilities.

† *Malayan Agricultural Journal,* Vol. XXIV, p. 309, *et seq.* July, 1936.

Abstract.

INTERNATIONAL GROCERS' EXHIBITION 1936.*

The Fortieth Annual International Grocers' Exhibition was held at the Royal Agricultural Hall, Islington, from 19th to 25th September, 1936.

Malaya was represented for the ninth year in succession, other Government participants being Canada, South Africa, Australia, New Zealand, India, the Irish Free State, and the National Mark and Marketing Board Schemes of the Ministry of Agriculture.

In previous years the Malayan stand has been situated in the Annexe known as Gilbey Hall, where space is cheaper than in the main building. But stands there are rather remote and not all who perambulate the main exhibits see them. One of the main stands was taken as an experiment this year, the higher rates being compensated by reducing the space occupied. The change was an unqualified success; the stand received more attention and was busier with inquiries than on any previous occasion.

The Malayan display, which was based on a pineapple diorama made by Mr. F. de la Mare Norris, late of the Malayan Department of Agriculture, consisted chiefly of canned pineapples under more than a score of varied labels, in sizes ranging from 1 lb. to 5½ lbs., and comprising the cuts: midget cubes, cubes, chunks, spiral slices, and round-cut slices. Of the minor products exhibited those which aroused most interest were the samples of tapioca displayed in presentation packets of cellophane.

Both the grades of canned pineapple sold on the Home market were displayed. The quality of the "Golden" opened on the stand was very good indeed. The "G.A.Q." might be described as passable, the chief defect being as usual the presence of unripe, woody and fibrous fruit. Generally speaking both grades were superior in quality to those shown in 1935.

The stand gave the trade an opportunity to see Malayan canned pineapple of good quality and provided what may perhaps prove in some measure an antidote to the bad impression created by the very inferior shipments during the summer.

Trade inquiries were very numerous. As many of them related to orders too small for the firms from which the Agency obtains its exhibition supplies to handle, the direct results cannot be assessed. But one incident may be cited. A representative of one of the larger direct importers of Malayan pines mentioned to the demonstrator that his firm wished to arrange a Continental agency. Almost the next inquirer was an important Amsterdam merchant who, after having examined the contents of various tins, stated that although his firm had hitherto handled only Hawaiian pines he would like to secure an agency for Malayan pines. The two inquirers were introduced to each other and the Agency was subsequently

* Abstracted from a Report received from the Agent, The Malayan Information Agency, London.

informed that a satisfactory connexion was being arranged. One single fresh outlet of this nature might well justify the entire cost of the stand, provided that care is taken to maintain the quality of the pack.

The increased interest taken in the Malayan stand can be attributed partly to the advertising campaign which the Agency has been carrying out this year with funds furnished by the Pineapple Packers' Agency and the Johore Government. All the leading grocery trade publications have carried advertisements addressed to retailers, and all the leading household publications in the country have contained advertisements addressed to the house-wife. The large majority of these publications also made appreciative editorial references in the trade papers, to the improvement in the Malayan industry, and in the popular publications, to the use of pineapples in cooking, etc. It was most disappointing to find as this campaign proceeded that it was synchronizing with the arrival in England of shipments which were much below the standard of those despatched during recent years.

Review.

Diseases and Pests of the Rubber Tree.

By Arnold Sharples. A.R.C.SC., D.I.C., *Late Head of the Pathological Division, Rubber Research Institute of Malaya, and formerly Government Mycologist, Department of Agriculture, S.S. and F.M.S. Macmillan & Co. Ltd., London, 1936. Price 25 shillings.*

Since the publication of Petch's standard work on the diseases and pests of the rubber tree, considerable progress has been made in the study of the principal diseases affecting this important crop, and the need for a more up-to-date book on the subject has been felt for some time.

In view of his close connexion with the subject, over a long period, in the principal rubber-producing country of the world, Mr. Sharples is undoubtedly well qualified to undertaken the task of writing such a book, and in the volume now published by Messrs. Macmillan & Co. Ltd., London, he has made a valuable addition to the growing series of hand-books dealing with diseases of the major tropical crops.

Publication of the book at the present juncture should be welcomed by the rubber planting communities in the East on account of the problems arising in connexion with replanting of old rubber areas with selected high-yielding material. These problems are discussed at length, and valuable recommendations are made relating to early prophylactic measures against the major root diseases. In addition, the question of forestry methods of cultivation receives full consideration.

The book is divided into three Parts, of which Part I is devoted to general remarks on plant diseases and on the structure, reproduction and physiology of fungi. Part II gives an account in simple terms of the anatomy of woody plants and the functions of the different tissues. These two parts could well serve as a text book in elementary structural and physiological botany of woody plants for candidates for the local I.S.P. certificate. Further anatomical details are included in a portion of Part III where the author gives an account of the adequate repair mechanism possessed by the rubber tree in the regeneration of bark tissues after wounding. This account is taken from the paper, by Sharples and Gunnery, published in the *Annals of Botany* in 1933.

Part III provides information on all the diseases and pests hitherto recorded on the rubber tree, with full discussions of the outside factors which render the trees liable to attack by facultative parasites. The damage caused by lightning and the after effects of bark scorching are described in detail in a chapter well worth study by phytopathological workers in countries where lightning storms are frequent.

The section on insect pests, which deals with "white ants," boring beetles, cockchafer grubs, and other insects of lesser importance, is followed by a chapter

on fungicides and disinfectants, which is of particular interest and makes clear the present position with regard to the use of these substances in combatting disease in the rubber tree.

The chapters on root diseases are perhaps the most important in the book. The author, accepting the conclusions reached by Napper that the centres of infection are "knots" of jungle tree infection already delimited at the time of felling, outlines methods of early treatment of newly planted areas for the control, not only of *Fomes lignosus,* which becomes evident in the earlier years, but also of *Ganoderma pseudoferreum* which takes longer to reach its maximum intensity but nevertheless may be present, and can be treated, in the early years of growth.

Every rubber planter is aware of the difficulties experienced in treating root disease and of the expense incurred in isolating infected areas in mature rubber. Any economical measures likely to prevent root diseases from appearing in areas replanted with valuable high-yielding material are worthy of consideration. In this respect the methods summarized on pages 137-139 with regard to *F. lignosus* should, if adopted, do much to protect the trees from subsequent attack by any root disease, so that areas which later might require trenching should be small both in extent and number, and expenditure on root disease treatment should be comparatively small.

Referring to the fungus *Rhizoctonia bataticola* which attained prominence in Ceylon some years ago as a result of Small's claims that this fungus was of primary importance in cases of root diseases of rubber and many other plants, the author gives convincing evidence that root diseases of the rubber tree, in Malaya, spread by root contact, and that the fungus *R. bataticola* is not associated with these diseases either in a primary or even a secondary capacity.

The final chapter (Chapter XXI) is headed "Forestry Methods of Cultivation." The "pros" and "cons" of this somewhat controversial subject are given, mainly from the phytopathological aspect. While the author is in full agreement with the fundamental principles which form the basis of the forestry method *i.e.* shading of the soil, prevention of erosion and supply of a suitable type of humus, he is critical of a system which advocates unrestricted freedom of natural undergrowths, coupled with selective weeding and repopulation of open spaces by self-sown seedlings. He considers that "the adoption of *controlled* forestry methods in any area, so improving the soil in readiness for the time when systematic replanting with high grade material can be undertaken, seems to offer valuable possibilities .... where the undergrowth is controlled so that growth in height is not allowed to exceed twelve to eighteen inches, substantial benefits may be derived in areas from which mouldy rot is absent."

With regard to mouldy rot, the author cites an instance where the disease could not be controlled by ordinary methods, due to the increased humidity induced by forestry methods.

The author considers that attempts to bud-graft self-sown seedlings in a stand of mature rubber of inferior grade should be abandoned in favour of complete repopulation with superior material, and explains clearly the reasons, partly con-

nected with the labour force on estates, why he does not favour any schemes designed to substitute "kampong" conditions for "estate" conditions in Malayan rubber plantations.

The Appendix contains a list of fungi recorded on rubber trees in Malaya. There are certain omissions from this list *e.g. Oidium heveae* and *Phytophthora heveae,* while *P. faberi* is listed instead of *P. palmivora* and *Fomes pseudoferreus* instead of *Ganoderma pseudoferreum*.

The author is to be congratulated on providing planter and scientist with an up-to-date, comprehensive account of the diseases and pests affecting *Hevea Brasiliensis,* and of methods for their control. The book, which is well illustrated (the coloured plate of Pink Disease is particularly good) should serve for many years as the standard work on this important subject.

A. T.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports from Agricultural Officers.

November, 1936.

The Weather.

The comparatively cool, dull weather, with high precipitation, usual for November, prevailed generally throughout the country during the month.

In Kedah, Province Wellesley and over most of the inland areas of Perak, rainfall was below normal during the first three weeks of the month, but heavy precipitation during the last week will probably bring the total rainfall figures near the average for the month. A slightly sub-normal precipitation is indicated for the inland areas of Selangor, the Kuala Pilah District of Negri Sembilan and the Segamat area of Johore.

The heavy rainfall in Malacca and adjoining areas in Negri Sembilan and in Muar, Johore, noted last month, continued during November, and the precipitation for these areas is again above average for the month.

Similarly, precipitation in excess of normal is recorded for Singapore and in the Johore Bahru area.

Heavy rainfall during the last week of the month in Ulu Kelantan brought the Kelantan River up to flood level throughout its course.

Remarks on Crops.

Padi.—In North Kedah, fairly large areas are affected by a fungus disease which causes withering of the leaves and subsequent stunting of the plants. Preliminary examination indicates *Sclerotium oryzae* as the probable cause of the trouble. Some 1,500 acres are estimated to be affected in Kota Star District.

In Province Wellesley, Krian and the North and Central Circles of Perak, the crop made good growth generally and prospects are promising except for the late planted areas of south-east Krian and parts of Penang and the south of Province Wellesley. At Bruas in Perak, the crop has again suffered from attacks of "penyakit merah", an affection which investigation so far indicates is due to physiological causes. In the Sungei Manik area the crop promises well on the older areas of Stage I, but prospects are not quite so good on the newer areas of Stage I or in Stage II. At the Panchang Bedena and Tanjong Karang areas in Selangor good headway was made with planting, water now being sufficient over most of the land under cultivation.

In Negri Sembilan, prospects are generally good, exception being the Kuala Pilah District where a fairly large aggregate area remains unplanted.

Further flood damage occurred in Malacca, although crop prospects are reported to be generally good.

In Pahang, some damage by floods is reported from Temerloh District.

Rubber.—There was a further rise in the price of rubber. In Province Wellesley the continued upward tendency has led to mild speculation by some local dealers who have bought fully up to Penang price in anticipation of a further rise.

Reports on the matter of smoke cabinets indicate how desirable it is to study local conditions before deciding upon the advice to be given to small-holders on this subject. It is reported from Province Wellesley that one small-holder in the south is obtaining a substantial profit from smoking his rubber before sale, although in other parts of the Province it has been definitely shown that it pays the small-holder to sell unsmoked sheet rather than to use a smoke cabinet. On the other hand, Johore Central report records that all of the Malay owners of smoke cabinets have ceased to use them, as the price margin between smoked and unsmoked is so small that the small-holder incurs a loss by smoking his own rubber before sale. The Perak South report records that smoke cabinets have proved useful in Batang Padang District, in that they act as the first stage in a general improvement in methods of rubber production; a small-holder with a cabinet begins to take an interest in his sheet and improves it in other respects.

Coconuts.—Copra showed a strong and sustained upward movement during the month, the Penang price for sundried rising from $6.35 a picul to $8.50. The seasonal decline in crop is again mentioned in some reports. In Bagan Datoh, prices for nuts for copra making increased to $24 per 1,000, whilst the Negri Sembilan report records prices of $5 per 100 being paid for nuts for domestic consumption. The marked increase for the latter is partly attributable to "bulan puasa", when the extra demand for nuts for domestic purposes usually leads to increased prices.

Agricultural Stations and Test Plots.

Agricultural Stations.—A revised lay-out for poultry prepared by the Principal of the School of Agriculture was authorised to be put in hand on the Singapore Station and a comprehensive manurial and planting distance experiment was prepared for the Pineapple Station at Kota Tinggi, Johore.

Padi Stations and Test Plots.—At Telok Chengai Station in Kedah, several plots have been affected with the disease mentioned earlier and thought to be due to *Sclerotium oryzae.* Growth was satisfactory at the Krian Station and Plots except at Briah and Selinsing, where plants have not recovered from the bad start occasioned by the prolonged dry weather in August, which caused seedlings to be kept too long in the nursery at Briah and resulted in the planting of weakly seedlings at Selinsing. At Bruas Test Plot in Perak, "penyakit merah" is again much in evidence. At the Sungei Manik Station, the long season Seraups appear to be making much more satisfactory growth than the shorter season strains. Transplanting was completed on the Panchang Bedena and Tanjong Karang Plots in Selangor. At Pulau Gadong Station in Malacca floods have held up weeding operations and prevented any work being done on the mechanical cultivation area. The crop has made poor growth of late on some portions of the Station, and the Rice Research Chemist visited during the month in connexion therewith.

DEPARTMENTAL NOTES.

Appointment of Adviser on Agriculture.

Mr. O. T. Faulkner, C.M.G., B.A., late Director of Agriculture, Nigeria, arrived in Malaya on the 26th November, 1936, and assumed duty on the 27th as Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States.

Meeting of the Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on the 12th November 1936, under the Chairmanship of the Hon'ble Mr. F. W. South, Acting Adviser on Agriculture. The varied aspects of Malayan agricultural industries were discussed, particular attention being directed to the proposals for the improvement of Malayan copra and canned pineapples by the adoption of a Malayan Mark Grading Scheme adapted to both industries.

The meeting was the last which Mr. South would attend prior to his departure from Malaya on retirement, and a vote of thanks for the valuable services which he had rendered on the Committee was recorded by a unanimous vote.

Farm School, Malacca.

The first year of the Farm School at Sungei Udang came to a close in November, and the presentation of certificates took place on the 17th November at 11 a.m. The Acting Director of Agriculture and the Chief Field Officer attended, and the certificates were given away by the Hon'ble the Resident Councillor, Malacca.

Leave.

Mr. A. E. Coleman-Doscas, State Agricultural Officer, Johore, has been granted 8 months and 11 days leave on full pay with effect from the 7th October 1936.

Mr. W. N. C. Belgrave, Chief Research Officer, has been granted 10 months and 4 days leave on full pay with effect from the 26th November 1936.

Mr. B. Bunting, Agriculturist, returned from leave on the 5th November, and resumed duty on the 6th November. Mr. Bunting has been appointed to act as Chief Research Officer during the absence on leave of Mr. Belgrave.

Statistical.

MARKET PRICES.

November 1936.

Major Crops.

Rubber.—The rapid rise in price recorded in October was continued during November, the Singapore price rising by more than 2 cents to exceed 31 cents per lb. Spot loose opened in Singapore at 29 3/16 cents per lb. and rose to 31 cents on the 18th and 19th November; thereafter it weakened slightly but improved again to reach 31 3/8 cents on the 27th, and closed at 31 5/16 cents.

The average price for the month of No. 1. X. Rubber Smoked Sheet was 30.37 cents per lb. as compared with 27.49 cents in October. The London average price was 8.56 pence per lb., and the New York price 17.84 cents gold as compared with 7.88 pence and 16.44 cents gold in the previous month.

Prices paid for small-holders' rubber at three centres during the month are shewn in the following table.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, November, 1936.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.				Kuala Kangsar, Perak.			Batu Pahat, Johore.			
	5	12	19	26	4	11	18	4	11	18	25
Smoked sheet	37.70	38.00	39.30			38.00	39.00				
Unsmoked sheet	36.00	37.00	38.00	37.77	34.50			35.20	36.50	37.80	37.10
Scrap			31.00								

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.
Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.
Transport from Kuala Kangsar to Prai by railway $6.20 per ton.
Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).
At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.
At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent.
No purchases at Kuala Kangsar on the 25th November.

Palm Oil.—The improved position of the market for the Malayan commodities is shewn in Table II.

Table II.
Prices of Palm Oil and Palm Kernels.

Date 1936.	Palm Oil in Bulk, c.i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
November 6	£ 23. 0. 0	£ 12. 10. 0
„ 13	23. 0. 0	12. 15. 0
„ 20	23. 0. 0	13. 10. 0
„ 27	24. 0. 0	13. 15. 0

Copra.—There was a remarkable advance in the price of copra during the month, the total rise exceeding $2 per picul although there was not a large volume of business passing. The sun-dried grade opened in Singapore at $6.20 per picul and rose steadily and rapidly to reach $8.50 on the 28th November, weakening slightly to close at $8.25 per picul. The average price for the month was $7.13 per picul, and for the mixed grade $6.79 per picul, as compared with $5.83 and $5.49 respectively in October.

Copra cake continued unchanged at $2 per picul.

Rice.—The average wholesale prices of rice per picul in Singapore in October were as follows:—Siam No. 2 (ordinary) $3.71, Rangoon No. 1 $3.30, Saigon No. 1 $3.40, as compared with $3.75, $3.47 and $3.77 respectively in September. The corresponding prices in October, 1935, were $4.37, $3.87 and $3.82.

The average retail market prices in cents per gantang of No. 2 Siam rice in October were: Singapore 24, Penang 29, Malacca 26, as compared with 25, 28 and 26 respectively in September.

The average declared trade value of imports of rice in October was $3.55 per picul, as compared with $3.60 in September and $3.52 in August.

Padi.—The Government Rice Mill, Krian, maintained its price unchanged at $1.90 per picul. Retail prices of padi ranged from 6 to 15 cents per gantang.

Pineapples.—Prices of canned pineapples were further reduced during the month, and closing prices per case were: Cubes $3.05, Sliced Flat $2.85, Sliced Tall $3.15, as compared with October closing prices of $3.25, $3.05 and $3.35 respectively.

Prices of fresh fruit per 100 were as follows:—Singapore $1.60 to $1.70; Johore, 1st quality $1.50 to $4, 2nd quality $1.20 to $3.50, 3rd quality 60 cents to $2; Selangor 90 cents to $1.50.

Beverages.

Tea.—Two consignments of upland, and eight of lowland, Malayan tea were sold on the London market during November, the former averaging 1s. 0¾d. and 1s. 1¼d. per lb., and the latter 11¾d. to 1s. 0½d. per lb.

Average London prices per lb. during November for consignments of tea from other countries were as follows:—Ceylon 1s. 2.82d., Java 11.79d., Indian Northern 1s. 0.8d., Indian Southern 1s. 0.36d., Sumatra 10.06d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report*, 24th November, 1936, of the Colombo Brokers' Association, and are as follows, in rupee cents per lb.:—High Grown Teas 70 cents, Medium Grown Teas 65 cents, Low Grown Teas 64 cents.

Coffee.—Prices of coffee improved considerably during November. Sourabaya averaged from $13.56 to $14.81 per picul, and Palembang averaged $10.12 to $12.19 per picul. October average prices were $12.30 to $13.30, and $7.75 to $9.25 respectively.

Spices.

Arecanuts.—The following are the averages of the ranges of Singapore prices per picul during November: Splits $7 to $9; Red Whole $5.15 to $6; Sliced $4.75 to $6.31.

The Singapore Chamber of Commerce prices rose considerably, average prices per picul being: Best $7.91, Medium $7.25, Mixed $6.50.

Pepper.—Prices continued nominal in Singapore but were marked up by sellers during the month. Closing prices per picul were: Singapore Black $8.50, Singapore White $16.50, Muntok White $17.

Nutmegs.—Both 110's and 80's were again quoted at the same prices during November and averaged $29.50 per picul as compared with $28.80 in the previous month.

Mace.—Siouw remained unchanged at $100 per picul throughout the month, as compared with the October average of $94. Amboina weakened, averaging $73 per picul as compared with $78.40 in October.

Cardamoms.—Green cardamoms were quoted during November in the Ceylon Chamber of Commerce reports at Rs. 2.00 to Rs. 2.21 per lb.

Miscellaneous.

Derris (*Tuba Root*).—The Singapore market was dull throughout the month and prices weakened by $2 per picul. Roots sold on a basis of rotenone content were quoted at $46 per picul, and roots sold on a basis of ether extract at $28 per picul, as compared with $48 and $30 respectively in October.

Gambier.—Singapore prices remained unchanged during November at $5.25 and $10.50 per picul for Block and No. 1 Cube respectively.

Tapioca.—Singapore prices continued unchanged throughout the month. Prices per picul were: Flake Fair $5.50, Seed Pearl $5.75, Medium Pearl $6.50.

Sago.—Pearl, Small Fair, was quoted throughout November at $4.60 per picul, and Flour, Sarawak Fair, averaged $3.19 per picul. October average prices were $4.63 and $3.13 per picul respectively.

Tobacco.—The general range of prices of locally-grown tobacco was as follows (per picul):—1st quality $18 to $45, 2nd quality $15 to $32, 3rd quality $10 to $20. Prices ranged from $70 to $80 in certain districts of Johore, and in Selangor $100 and $75 per picul were reported for 1st and 2nd quality respectively. The range of prices in Kedah was $80, $70 to 90, and $55 to $70 per picul.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Kohyei & Co., Singapore.

1 picul = $133\frac{1}{3}$ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57 Trafalgar Square, London, W.C. 2.

GENERAL RICE SUMMARY*

October 1936.

Malaya.—Imports of foreign rice during October were 64,177 tons,† and exports 15,265 tons, net imports being 48,912 tons. Net imports for the ten months January to October aggregated 440,545 tons as compared with 407,949 tons in 1935.¶

Of the October imports 51 per cent. were consigned to Singapore, 12 per cent. to Penang, 7 per cent. to Malacca, 23 per cent. to the Federated Malay States, and 7 per cent. to the Unfederated Malay States. The imports by countries of origin were as follows (in tons, percentages in brackets):—Siam 43,729 (68.1); Burma 17,104 (26.7); French Indo-China 2,690 (4.2); other countries 654 (1.0).

Of the October imports 71 per cent. were consigned to the Netherlands Indies, and 29 per cent. to other countries. The various kinds of rice exported were as follows (in tons, percentages in brackets):—Siam 12,598 (82.5); Burma 1,945 (12.7); French Indo-China 541 (3.6); parboiled 131 (0.9); local production 50 (0.3).

India and Burma.—Foreign exports for the period January to September 1936 totalled 1,049,000 tons, as compared with 1,416,000 tons in 1935, a decrease of 25.9 per cent. Of these exports 3.5 per cent. were to the United Kingdom, 17.0 per cent. to the Continent, 29 per cent. to Ceylon, 21.7 per cent. to the Straits Settlements and the Far East, and 28.8 per cent. to other countries. The corresponding 1935 percentages were 4.2, 10.5, 23.7, 31.9, and 29.7

According to the first rice forecast for All-India for the season 1936-37 (*Indian Trade Journal*, 5th November 1936), the total area sown is reported to be 77,786,000 acres as against 75,698,000 acres, the corresponding estimate (revised) of last year.

Reports indicate (*Bangkok Times*, 26th October 1936) that the sown area in Burma is approximately up to normal.

Siam.—Exports of rice and rice products from Bangkok during August were 134,826 tons; the total for the eight months was 1,078,851 tons as compared with 1,009,641 tons in 1935.

According to reports received from sixty provinces of Siam, approximately 6,944,915 acres had been planted with rice by the end of October, a decrease of about 640,000 acres as compared with 1935.

There is a heavy increase in the damaged rice land, largely caused by lack of rainfall, other causes being flood, crabs and insects. The damaged area amounts to 865,978 acres as compared with 672,201 acres at the same time last year.

Japan.—The rice crop for Japan for 1936 was estimated at 9,514,727 tons, or 17.1 per cent. above the actual crop of last year, and 14.1 per cent. above the average of the last five years. The Korean rice crop for 1936 was estimated at 2,798,036 tons, or 11.3 per cent. above the actual crop of last year.

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* Abridged from the Rice Summary for October 1936, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† Tons = long tons (2,240 lbs.).

¶ It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935.

The area under rice for the second Formosan rice crop of 1936 was estimated at 938,791 acres, a decrease of 0.52 per cent. as compared with the corresponding figure of last year. The estimated crop is 714,426 tons.

French Indo-China.—Entries of padi into Cholon during the first ten months of 1936 totalled 1,380,620 tons as compared with 1,497,366 tons in 1935, a decrease of 7.8 per cent. Exports of rice during the same period were 1,496,509 tons, as compared with 1,555,321 tons in 1935, a decrease of 3.8 per cent.

The Netherlands Indies.—The latest information available was published in the July Summary.

Ceylon.—Imports during January to October 1936 aggregated 435,247 tons, as compared with 444,392 tons in 1935, a decrease of 2.1 per cent. Of these imports 13.9 per cent. were from British India, 62.8 per cent. from Burma, 0.5 per cent. from the Straits Settlements, and 22.8 per cent. from other countries. The corresponding 1935 percentages were 12.9, 68.2, 0.8, and 18.1.

Europe and America.—Shipments from the East to Europe during the period 1st January to 8th October totalled 1,016,085 tons, as compared with 604,023 tons in 1935, an increase of 68.2 per cent. Of the 1936 shipments 28.1 per cent. were from Burma, nil from Japan, 62.9 per cent. from Saigon, 8.1 per cent. from Siam, and 0.9 per cent. from Bengal. The corresponding percentages for 1935 were 52.6, 3.9, 37.0, 4.7 and 1.8.

Shipments for the Levant from 1st January to 6th October totalled 11,060 tons as compared with 26,739 tons in 1935, a decrease of 58.6 per cent. Shipments for Cuba, West Indies and America from 1st January to 8th October totalled 208,472 tons, an increase of 8.4 per cent. when compared with 192,404 tons in 1935.

MALAYAN AGRICULTURAL EXPORTS, OCTOBER, 1936.

PRODUCT.	Net Exports in Tons				
	Year 1935	Jan.-Oct. 1935	Jan.-Oct. 1936	October 1935	October 1936
Arecanuts ...	21,885	18,702	23,781	2,670	2,543
Coconuts, fresh † ...	106,272†	90,623†	98,769†	11,665†	5,744†
Coconut oil ...	35,911	28,270	39,291	3,701	4,472
Copra ...	111,752	84,043	62,744	6,079	6,631
Gambier, all kinds ...	2,837	2,440	1,759	372	165
Oil cakes ...	11,361	8,902	13,135	1,524	1,139
Palm kernels ...	3,892	3,118	4,133	526	713
Palm oil ...	24,996	19,035	23,772	2,239	2,682
Pineapples canned ...	73,923	59,159	67,803	3,790	3,912
Rubber ¶ ...	378,381¶	326,731¶	301,958¶	34,588¶	36,799¶
Sago,—flour ...	10,920	7,945	6,239	1,435	363*
,, —pearl ...	4,655	3,939	2,794	460	353
,, —raw ...	7,735*	6,089*	6,059*	940*	565*
Tapioca,—flake ...	1,953	1,625	1,303	193	87
,, —flour ...	755*	524*	1,603*	7	201*
,, —pearl ...	17,169	15,042	14,702	2,023	1,836
Tuba root ...	567	469	516	39	26

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS (IN LONG TONS)

(As declared by Estates)

Month 1936	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S
January ...	1,395.4	326.5	258.6	37.2
February ...	1,531.9	372.4	244.2	54.6
March ...	1,878.4	534.5	302.9	88.0
April ...	1,410.6	446.8	250.0	80.0
May ...	1,346.1	644.8	238.1	114.6
June ...	1,557.4	658.3	245.5	100.9
July ...	2,270.5	975.7	349.1	147.6
August ...	2,963.2	1,029.0	419.2	163.0
September ...	2,671.5	969.9	394.2	136.9
October ..	2,312.3	928.6	434.6	133.0
Total ...	19,337.3	6,886.5	3,136.4	1,055.8
Total January to October 1935 ...	14,722.8	5,035.4	2,157.6	176.8
Total for year 1935 ...	17,338.7	5,764.6	2,711.1	818.4

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 31ST OCTOBER, 1936.

State or Territory	Acreage of Tappable Rubber end 1935	Estates which have entirely ceased tapping		Estates which have partly ceased tapping (a)		Area of Tappable Rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,526	400	0.9	16,119	36.2	521	1.2	16,519	37.1
Malacca	121,601	4,325	3.6	29,678	24.4	2,848	2.3	34,003	28.0
Penang Island	2,575	675	26.2	503	19.5	264	10.3	1,178	45.7
Singapore Island	34,525	3,561	10.3	9,901	28.7	334	1.0	13,462	39.0
Total S.S. ...	203,227	8,961	4.4	56,201	27.7	3,967	2.0	65,162	32.1
FEDERATED MALAY STATES :—									
Perak	294,988	9,374	3.2	69,796	23.6	14,537	4.9	79,170	26.8
Selangor	332,165	10,721	3.2	64,113	19.3	14,803	4.5	74,834	22.5
Negri Sembilan	258,304	10,951	4.2	53,830	20.9	16,252	6.3	64,781	25.1
Pahang	77,210	10,919	14.1	24,631	31.9	16,974	22.0	35,550	46.0
Total F.M.S. ...	962,667	41,965	4.3	212,370	22.1	62,566	6.5	254,335	26.4
UNFEDERATED MALAY STATES :—									
Johore	432,443	32,567	7.5	63,597	14.7	38,830	9.0	96,164	22.2
Kedah	199,607	14,699	7.4	25,400	12.7	15,329	7.7	40,099	20.1
Kelantan	30,474	403	1.3	9,002	29.5	3,768	12.4	9,405	30.9
Trengganu (b)	4,643	Nil	Nil	Nil	Nil	138	3.0	Nil	Nil
Perlis (c)	1,575	Nil	Nil	761	48.3	59	3.7	761	48.3
Brunei	6,010	Nil	Nil	1,662	27.7	963	16.0	1,662	27.7
Total U.M.S. ...	674,752	47,669	7.0	100,422	14.9	59,087	8.8	148,091	21.9
TOTAL MALAYA ...	1,840,646	98,595	5.4	368,993	20.0	125,620	6.8	467,588	25.4

Notes :—(*a*) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(*b*) Registered Companies only.
(*c*) Rendered quarterly.

MALAYAN RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF OCTOBER, 1936, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January to Oct. 1936		during the month		January to Oct. 1936						
	Ports	Dealers	Estates of 100 acres and over	during the month	January to Oct. 1936	during the month	January to Oct. 1936	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to Oct. 1936
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	5,418	12,575	10,867	101,885	8,734	54,075	Nil	Nil	Nil	Nil	13,231	5,339	115,321	40,054	...	7,511	11,501	12	97
Johore ...	...	1,876	4,517	3,979	40,982	4,682	32,198	Nil	24	Nil	769	3,108	5,101	22,978	49,956	...	2,726	4,143	...	...
Kedah ...	...	196	2,870	2,843	25,694	1,247	7,587	Nil	Nil	Nil	Nil	1,520	2,244	14,262	19,192	...	480	2,912	...	...
Perlis ...	...	11	17	14	112	33	198	Nil	Nil	Nil	Nil	Nil	34	Nil	293	...	24	17	...	...
Kelantan ...	...	203	387	316	2,913	979	5,835	Nil	Nil	Nil	Nil	239	1,059	1,494	7,218	...	305	282	...	...
Trengganu ...	...	55	50	226	2,254	113	1,127	Nil	Nil	Nil	Nil	Nil	339	Nil	3,381	...	55	50	...	...
Brunei ...	...	2	54	55	441	102	635	...	...	...	...	...	152	...	1,068	...	24	37	...	...
Total Malay States	...	7,761	20,470	18,300	174,281	15,890	101,655	Nil	24	Nil	769	18,098	14,268	145,055	121,162	...	11,125	18,942	12	97
S. SETTLEMENTS :—																				
Malacca ...	...	2,348	1,224	1,087	10,171	659	5,808	Nil		Nil		3,162		24,331		...	1,991	1,087	...	...
Province Wellesley	...	829	568	439	4,085	196	2,150	Nil		Nil		7,837		73,426		...	1,060	544	...	...
Penang ...	2,203	3,511	5	13	153	31	831	2,882	13,424	26,049	114,771		Nil		Nil	2,024	3,504	7	...	...
Singapore ...	5,999	15,223	129	123	1,405	47	1,259	10,031		114,431		17,302		182,274		4,814	14,251	171	34	261
Labuan ...	...	17	Nil	Nil	Nil	14	16)	50		641		Nil		Nil		...	14	Nil	...	...
Total Straits Settlements ...	8,202	21,928	1,926	1,662	15,814	947	10,208	12,963	13,424	141,121	114,771	28,301	Nil	280,031	Nil	6,838	20,820	1,809	34	261
Total Malaya ...	8,202	29,689	22,396	19,962	190,095	16,837	111,863	12,963	13,448	141,121	115,540	46,399	14,268	434,086	121,162	6,838	31,945	20,751	46	358

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	6,394	13,836	3,274	2,627	2,245	229
WET RUBBER	1,117	415	230	462	481	251
TOTAL ...	7,511	14,251	3,504	3,089	2,726	480

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to Oct. 1936
29	30	31
Singapore ...	28,985	274,050
Penang ...	11,617	106,720
Port Swettenham.	5,576	49,878
Malacca ...	221	3,438
MALAYA ...	46,399	434,086

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to Oct. 1936
32	33	34
Malay States ...	32,366	275,217
Straits Settlements	2,843	25,323
MALAYA ...	35,259	300,540

Notes:—
1. Stocks on estates of less than 100 acres and stocks in transit *on rail*, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 25th November, 1936.

METEOROLOGICAL SUMMARY, MALAYA, OCTOBER, 1936.

Locality.	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B.	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total		Most in a day. Amt.	Number of days: Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog mornings obs.	Gale force 8 or more	Bright Sunshine: Total.	Daily Mean.	Per cent.
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	90.1	72.1	81.1	95	70	79	74	83.9	84.9	9.49	241.1	2.06	23	21	5	4		151.75	4.89	40
Bukit Jeram, Selangor ...	88.5	72.1	80.3	93	70	82	74	84.7	86.1	7.16	181.9	2.07	23	16		1	1	179.00	5.77	48
Sitiawan, Perak ...	87.8	73.2	80.5	93	70	82	76	83.7	84.6	6.74	171.2	1.20	24	19				162.90	5.25	44
Temerloh, Pahang ...	87.6	72.2	79.9	91	70	75	74	85.1	86.2	10.87	276.1	2.79	22	17	1	3		158.55	5.11	42
Kuala Lipis, Pahang ...	87.7	71.2	79.5	92	68	77	74	83.4	84.7	13.91	353.3	2.12	22	20	2	14	1	139.85	4.51	38
Kuala Pahang, Pahang ...	85.3	73.7	79.5	91	71	74	75	83.3	86.2	24.11	612.4	4.90	21	19	2			142.90	4.61	38
Kallang Aerodrome, S'pore ...	84.6	74.7	79.7	89	71	77	80	81.8	83.7	11.57	293.9	2.46	23	19			1	138.80	4.48	37
Butterworth, Province Wellesley ...	86.9	73.9	80.4	91	72	82	77	84.5	85.4	14.25	362.0	2.42	18	16	2			162.60	5.25	44
Bayan Lepas Aerodrome Penang ...	86.3	74.4	80.3	90	69	81	77	83.3	83.9	13.97	354.9	2.40	21	16	2		1	150.10	4.84	40
Bukit China, Malacca ...	84.8	73.1	78.9	88	70	76	77	83.0	84.4	13.61	345.7	3.35	24	19	2		1	167.65	5.41	45
Kluang, Johore ...	87.0	71.4	79.2	91	68	76	74	81.2	82.2	14.64	371.9	2.17	26	24	6	3		126.75	4.09	34
Bukit Lalang, Mersing, Johore	84.1	71.7	77.9	90	69	77	73	81.0	81.8	24.20	614.7	3.62	24	23	3			129.75	4.19	35
Alor Star, Kedah ...	87.0	73.7	80.3	91	72	80	78	83.3	84.3	14.97	380.3	5.29	20	17				153.30	4.95	41
Kota Bahru, Kelantan ...	85.8	73.1	79.5	92	71	75	75	83.8	85.3	26.68	677.7	13.04	26	22	3		2	137.20	4.43	37
Kuala Trengganu, Trengganu	84.7	72.6	78.7	90	71	77	74	81.7	83.5	30.12	765.1	7.95	25	22	2	1	2	135.90	4.38	37
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	72.7	62.1	67.4	78	59	63	65	71.4	72.3	12.24	310.9	1.98	26	21		18		117.55	3.79	32
Cameron Highlands. Tanah Rata, Pahang 4750 ft. ...	71.1	58.1	64.6	77	51	65	62	70.2	70.2	8.72	221.5	1.64	27	26	2	1		115.70	3.73	31
Cameron Highlands. Rhododendron Hill, Pahang 5120 ft. ...	70.6	59.3	64.9	77	57	62	61			9.13	231.9	2.29	27	22			1	119.40	3.85	32

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